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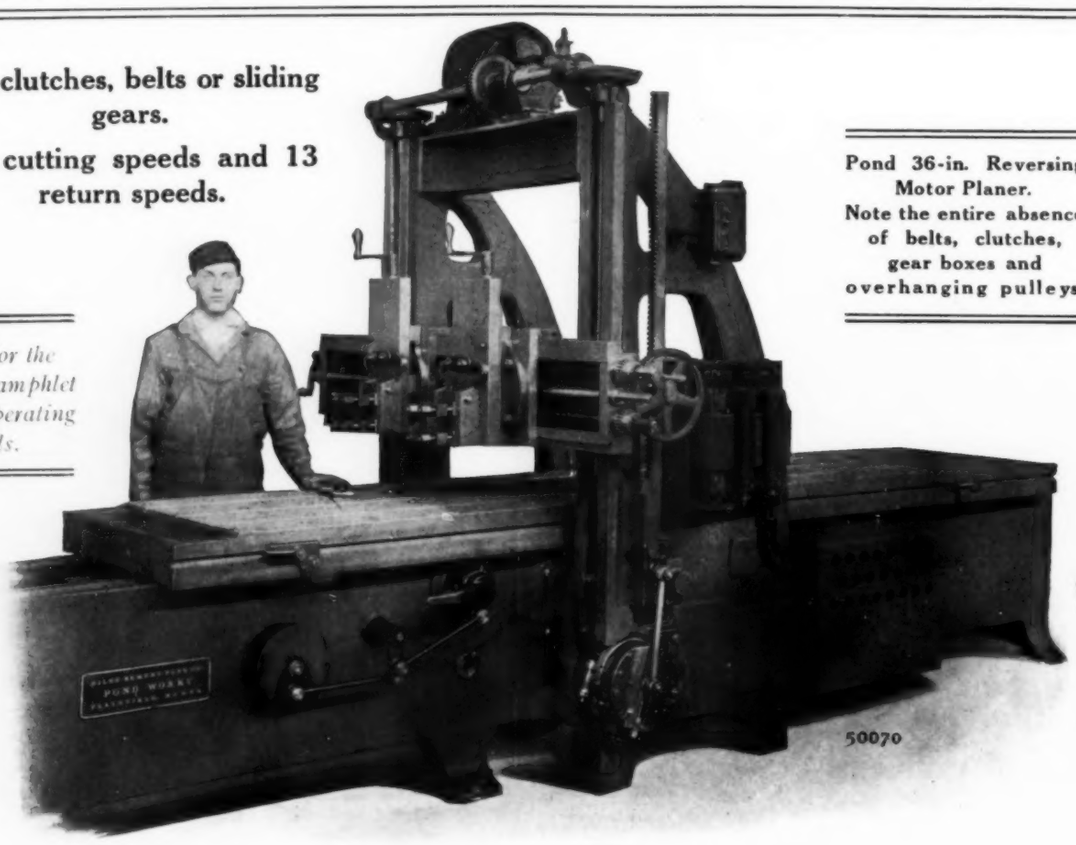

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(*See pages* 43, 44, 45 *and* 46)

The Manufacture of Lifting Jacks

By F. A. Stanley

Operations in making hydraulic, lever and screw jacks accomplished in special drilling and boring machines and gear cutters and on lathes converted into thread millers. Jigs under the drill press are applied in connection with an indexing fixture that allows the operator to bring one side of the work after another into position under the spindle.

Fixtures fitted to the milling machine enable bevel gear teeth to be readily cut and hexagonal hubs on pinions to be straddle milled milled. Other features of an interesting plant, including a testing machine, a handy shop truck, etc.

The Joyce-Cridland Company, Dayton, Ohio, manufactures a complete line of lifting jacks, including hydraulic, plain-and-geared-lever, and screw jacks of various types. Their methods involve the use of a variety of special machines and tools, most of which were designed and built by the firm itself. A number of these tools and their applications are illustrated in the accompanying engravings.

Machines for Boring Cylinders

Figs. 1 and 2 show two views of a three-spindle, upright machine for drilling and boring steel cylinders for hydraulic jacks, which are made in different capacities up to 200 tons. The material in these cylinders is 40-carbon, open-hearth steel, cut approximately to length from the bar, and then brought to the vertical machine for the drilling of the hole.

The machine is equipped with three spindles, all operated independently, as to drive and feed, and under each spindle is a chuck for the work, consisting of a casting with a semi-circular opening large enough to admit the steel cylinder and having two yokes at the front to receive set screws which with the screws tapped in from the sides of the chuck, hold the work securely.

The Tools Used

Drills up to three inches diameter are used in these spindles, and after the twist drills have opened up a hole through the solid stock, removing most of the metal necessary in the operation, they are followed by four-lip or other end-cutting tools and then reamed. Complete sets of tools for the different spindles are provided and a big range of work is handled.

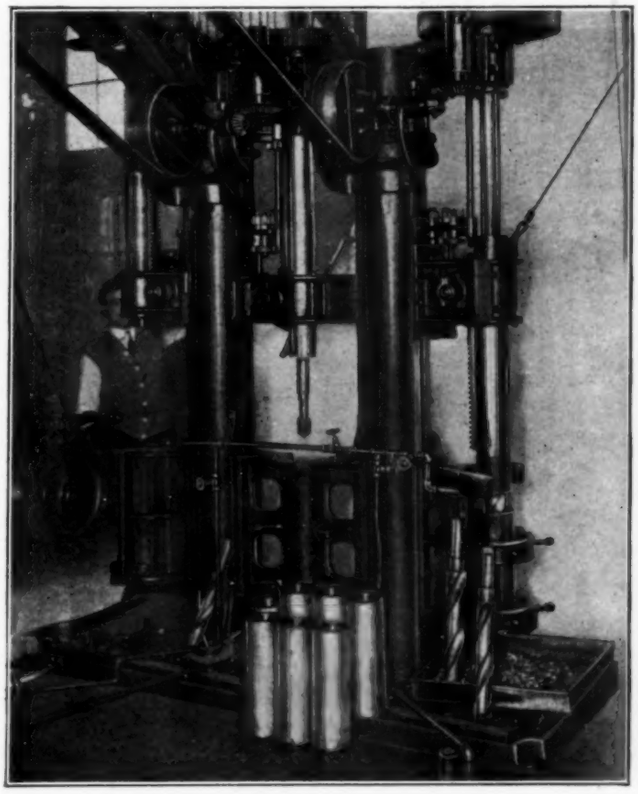
The method of driving is shown plainly in the side view, Fig. 1, and the feeding mechanism will be seen in the opposite view, Fig. 2.

Some idea of the range of cylinder sizes bored in this fashion will be gathered from Fig. 3, which is a group of a couple of hundred or more cylinders for both small and large jacks, though the very largest and the smallest sizes made here do not happen to be included in the view.

Some Jack Jigs and Fixtures

In Figs. 4, 5 and 6, a fixture is illustrated for assisting in the machining of certain parts of the frame of an automatic geared-lever jack. The assembled jack and the open frame are shown in Fig. 7.

A few of the operations performed under the drill press consist in boring out an opening in the frame to receive a shoulder on the inner face of the cover; facing the rim around the opening to form a seat for the cover; boring and facing a hub at the rear for a bearing for



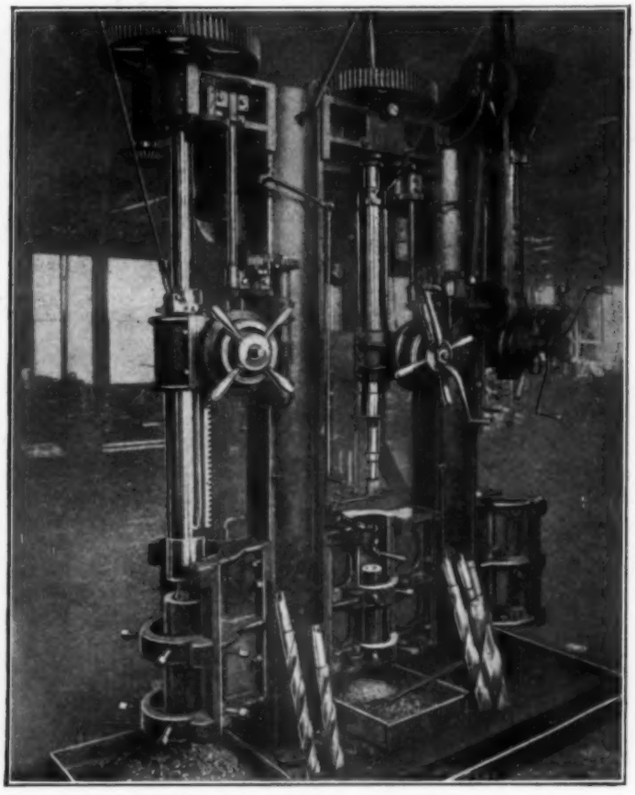


Fig. 1 Two Views of a Machine for Drilling Hydraulic Jack Cylinders Fig. 2

the rack-operating pinion; drilling and tapping for the cover-holding screws; etc.

Fig. 4 shows how the jack frame is mounted upon an indexing fixture which enables the operator to bring one side after another quickly into position under the drill spindle. The fixture is long enough to admit the different hights of jack frames, and the work is placed upon a square bar between the uprights, the bar fitting easily in the square opening in the frame, which afterward receives the jack bar. In Fig. 4, the operation illustrated is that of boring out and facing the cover seat.

The hole for the pinion bearing through the back of the frame has already been machined, and in Fig. 4 the boring and facing head is shown mounted upon a bar that is piloted in the bearing below. The cutter head carries tools at each side and its operation is performed rapidly. The facing tool for the inner bearing of the pinion just referred to, will be noticed at the front of the fixture base.

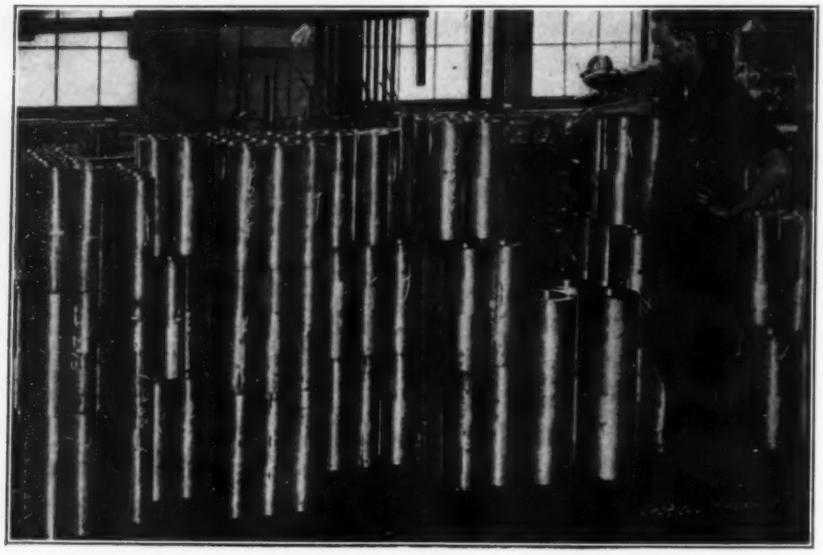


FIG. 3. A GROUP OF HYDRAULIC JACK CYLINDERS

LATER OPERATIONS

Following the machining of the cover seat, a jig, duplicating in appearance the cover itself, is placed upon the frame as in Fig. 5, for the drilling of the cover-retaining screws. The locating shoulder or ledge, under this jig is a snug fit in the opening bored out in the jack frame, so that the jig when properly seated will hold itself in place while a couple of holes are drilled, after which two locating pins are slipped through the two holes, as indicated in the halftone, and these are relied upon to hold the jig securely while the remainder of the screw holes are drilled.

The jig is then removed and the holes tapped. Quick-change sockets are used for drills and taps to facilitate the work. The holding fixture is next indexed to give another position to the work, and after certain other holes are drilled, the open jig shown in Fig. 6, is mounted on the jack frame and held by a bolt and stud passing through the holes just drilled. With the aid of this bracket-shaped jig the remainder of the holes are drilled in the jack frame. The positions of these holes will be seen upon examining the views of the jack frames in Fig. 7.

THE GEARING IN THE JACKS

An interior of a jack of this type, though of a different size, is illustrated in Fig. 8, which shows clearly the arrangement of the main gear, the lever pinion that operates the gear, and the re-

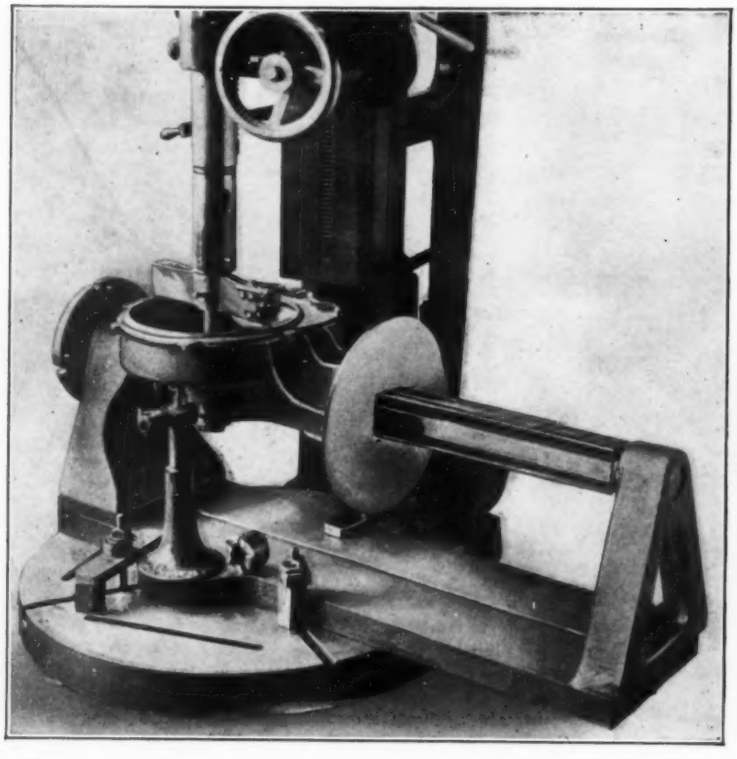


FIG. 4. BORING AND FACING COVER SEAT IN AUTOMATIC GEARED-LEVER JACK FRAME

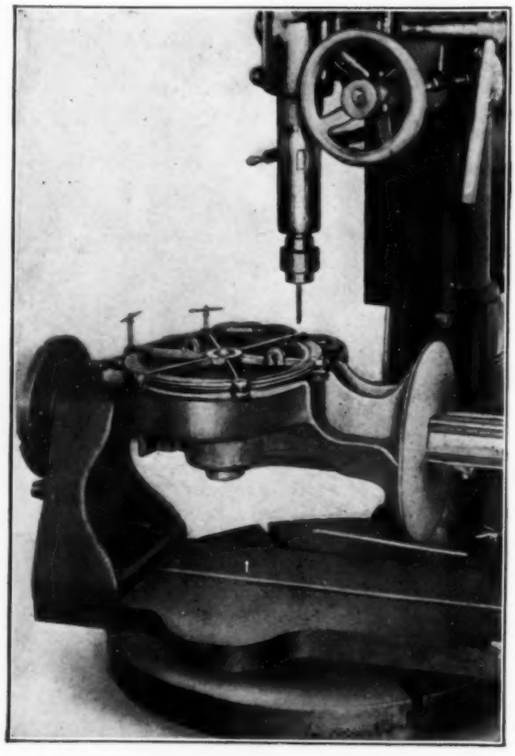


FIG. 5. DRILLING THE HOLES FOR ATTACHING THE COVER TO AUTOMATIC GEARED-LEVER JACK FRAME

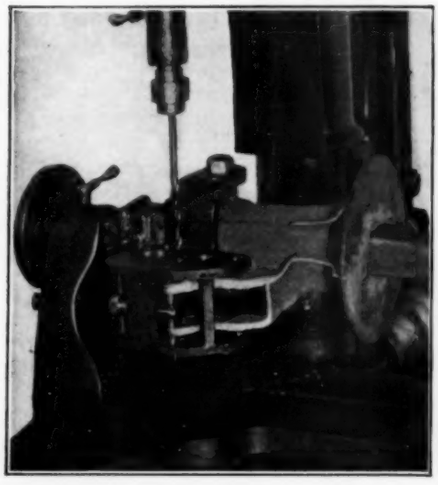


FIG. 6. ANOTHER SETTING OF THE JACK-DRILLING FIXTURE

FIG. 7. AUTOMATIC GEARED JACK

taining pawl which is provided with double teeth, so that the load whether being lifted or at rest, is always taken upon two teeth. The shape of the gear teeth and of the teeth on the jack bar and its operating pinion, is well brought out by this engraving, which shows the parts in detail. As the pressure on all of the teeth is always in one direction, these teeth are "buttressed" to strengthen them against the load from that direction. This form of tooth is also visible in Figs. 9 and 10, which illustrate some operations in the machining of the gearing.

OPERATIONS ON GEARS

The machine in Fig. 9 is a homemade gear cutter, which is used in milling the teeth of gear wheels of the type seen in Fig. 8. A multiple cutter is used for operating on several teeth at once, and as the teeth to be cut approximate a ratchet tooth in form, the cutter, in order to clear the straighter side of the teeth, is shaped to operate at one side of the center line. That is, its longitudinal section would appear like half of a Hindley worm, and while the teeth at one end are machining the lowermost tooth on the blank, the other portions of the cutter are at work along up on the other side of the gear.

The pinion for the jack bar is seen more clearly in Fig. 10, which illustrates a method of milling the hexagonal hub which fits the broached hole in the main-gear hub, as represented in Fig. 8. After the teeth of these pinions have been cut to the form shown to adapt them to work properly with the rack teeth on the side of the jack bar, the pinion is mounted on the indexing fixture, Fig. 10, where it is passed between a pair of inserted-tooth straddle mills which, in conjunction with the indexing movements of the fixture, produce the hexagonal form required on the hub.

A BEVEL-GEAR CUTTING FIXTURE

Another milling-machine fixture is shown in Fig. 11. This is a device for facilitating the cutting of the teeth in bevel gears used on a screw type of jack. The fixture is used on a plain miller and is designed to swivel upon its base to any angle likely to be required; the work spindle can be rolled to one side or the other independent of the regular index plate. The side angle is thus well provided for and the teeth are cut in two passes of the cutter, one at either side of the center.

This method was used temporarily in producing bevel gears for a new type of

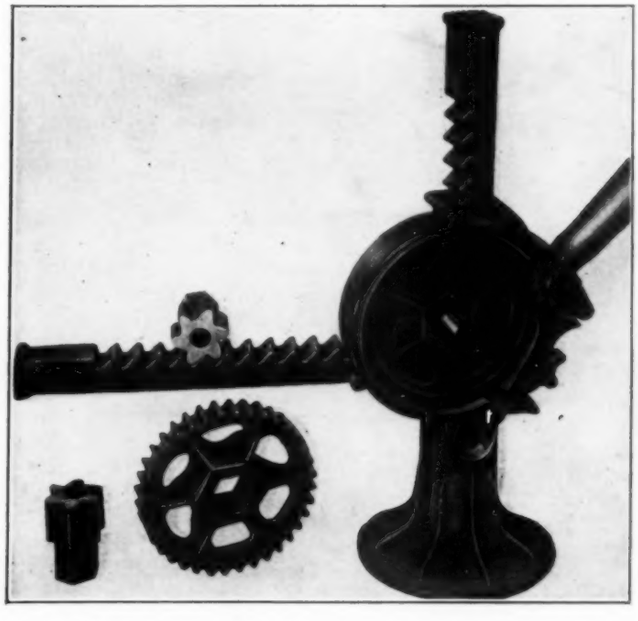


FIG. 8. A JACK AND ITS DETAILS, SHOWING PECULIAR FORM OF GEAR TEETH

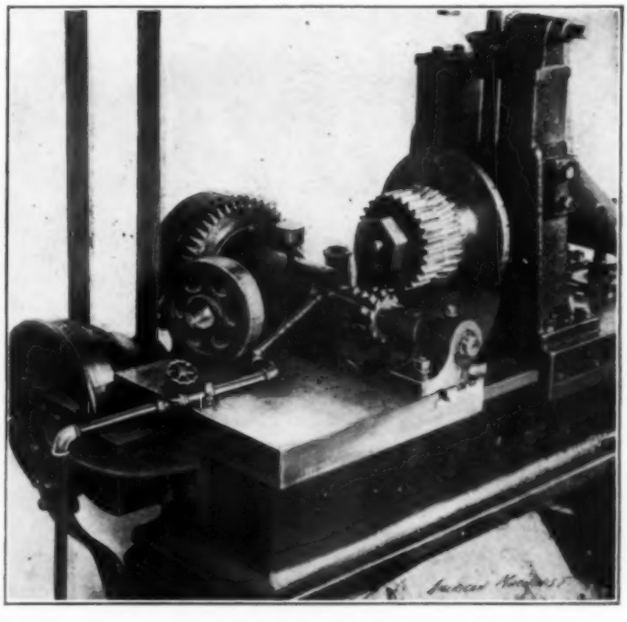


FIG. 9. CUTTING THE GEAR TEETH IN HOMEMADE MACHINE

jack prior to the installation of a bevel-gear planer which, of course, has many times the capacity of this fixture.

Milling Threads on Jack Screws

The threads of the Joyce-Cridland screw jacks are of a buttress, or ratchet form, with flat top and bottom, as indicated by the sketch, Fig. 12. The load is thus taken on the broad, flat side of the thread, and the angular side of the threads is not required to take a bearing at all. For cutting the threads a lathe converted into a thread miller is employed. The stock used is long enough for two screws and after cutting one to the necessary length, the blank is reversed, end for end in the centers and the thread cut up from a second end, after which the two jack screws are cut apart.

Two views of the thread-milling apparatus are given in Figs. 13 and 14. The drive for both cutter head and spindle is taken by one belt from the countershaft, and in the case of the head, is transmitted to the spindle by means of worm gearing to give the necessary speed reduction. The spur gear on the end of the spindle actuates a train of gearing which connects with the feed screw located along the center of the bed for traversing the carriage.

The Cutter Head and Drive

The drive for the cutter head is taken from a shaft at the rear through a pair of bevel gears, which operate a short shaft having universal joints at either end and which in turn drives a second pair of bevels, at the top of the cutter head; these bevel gears actuate a set of spur gears that drive the cutter spindle. The arrangement of the gearing and the connecting shafts is such that the cutter head may be tilted either up or down to give the cutter spindle an inclination sufficient to bring the path of rotation of the cutter into approximate coincidence with the helix angle of the thread that is to be cut. The cutter head also swivels in the horizontal plane.

In Fig. 15, a sketch is reproduced to show the general scheme by which the straight side of the buttress thread is produced with the rotating cutter. It will be noticed that, although one side of the thread is straight, the cutter is beveled on both faces. It is so formed on its normal section that in order to cut the straight face of the thread, the cutter must be swung around in the horizontal plane through a considerable angle to bring the left face of the cutter at right angles to the axis of the screw which is to be cut. At the same time, in forming up the cutter, provision is made so that it will cut the correct form of thread when the cutter axis is tilted in the vertical plane somewhat as indicated in the sketch, which shows the arrangement as it would appear with the observer looking directly down upon it. It is evident from this diagram, that the cutter will produce a square-sided thread and clear that side of the thread in its operation.

If the cutter were used on a left-handed thread, the head would be tilted downward to the left to incline the cutter in the same direction as the slope of the thread. In other words, if the sketch, Fig. 15, were drawn to represent the action on the left-hand thread, the right-hand side of the cutter (instead of the left) would be visible to the eye as an ellipse, when viewed directly from above.

Features of Operation

In cutting jack screws with this thread-milling arrangement, it is customary to make but one pass across the work, the full length of the one screw, after which the double length of steel is turned end for end between the centers to bring the blank end into position for threading. The work is supported near the middle by the steady rest.

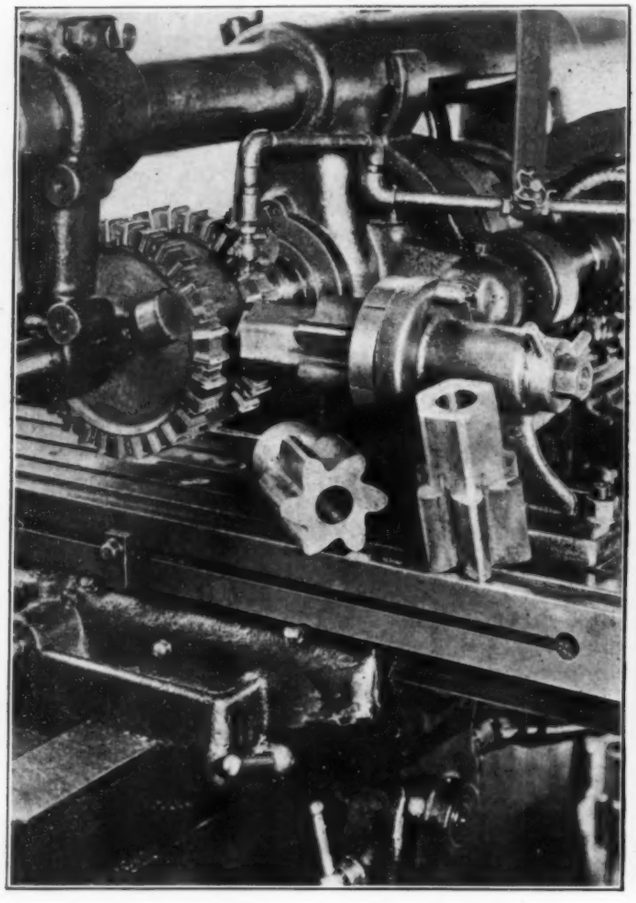


Fig. 10. Milling Hexagon Hub on Gear Pinion

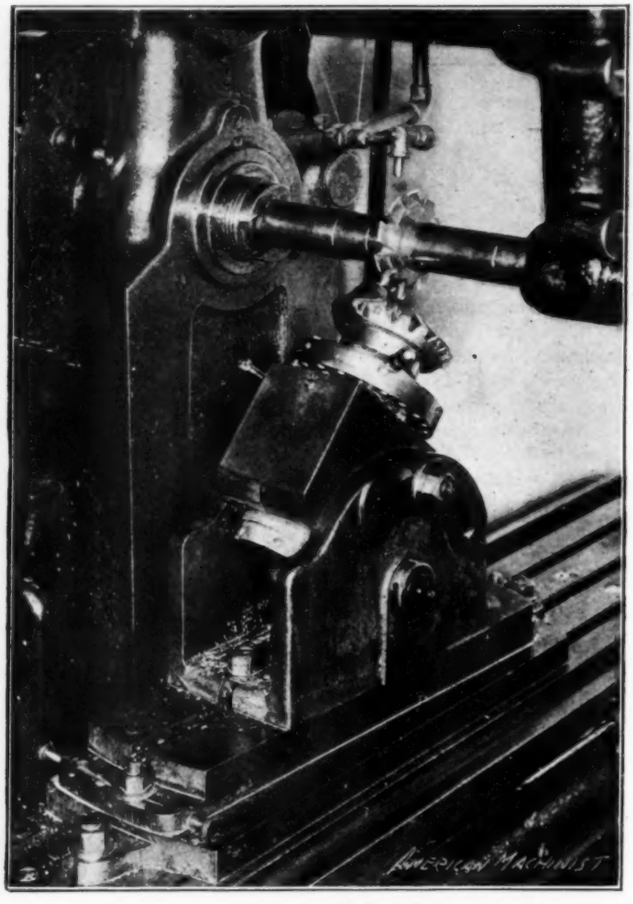


Fig. 11. Bevel Gear Milling Fixture

A rod near the bottom of the bed is operated by the movement of the carriage to release the drive and stop the machine upon the completion of the cut. This stop rod extends past the end of the bed and normally carries a ring connected by a cord with a spring-controlled countershaft, and when the carriage approaches the end of its movement it causes the stop rod to be forced quickly along in its guides, releasing the ring and allowing the countershaft to stop.

For setting the cutter to depth, a gage in the form of a ring fitting the cylindrical portion of the tail center, is slipped onto the center, and the cutter slide is then adjusted until the point of the cutter tooth just contacts with the outside of the gage ring. The latter is, of course, made to the diameter of the core of the thread. Two gages of this type will be seen lying upon the tailstock base in Fig. 14.

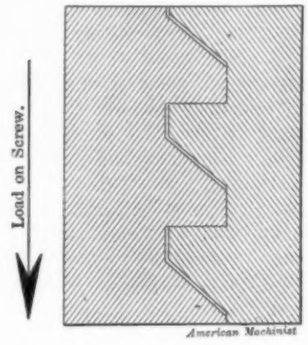


FIG. 12. THREADS OF A JOYCE-CRIDLAND SCREW JACK

FIG. 17. HANDY SHOP TRUCK

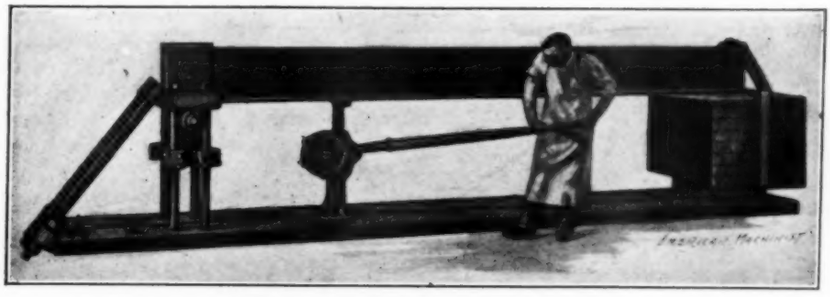


FIG. 16. TESTING MACHINE FOR JACKS

A TESTING MACHINE FOR JACKS

The apparatus in Fig. 16 was built at this shop for direct testing of various kinds of jacks. The testing machine consists of a steel beam about 15 feet long, fulcrumed at one end and adapted to be loaded at the other with from one to seven 800-pound weights. The base of the machine is bedded in reinforced concrete, and the saddle at the upper end for the fulcrum blocks is tied down by a series of heavy rods passing through the bed. When not in use the beam

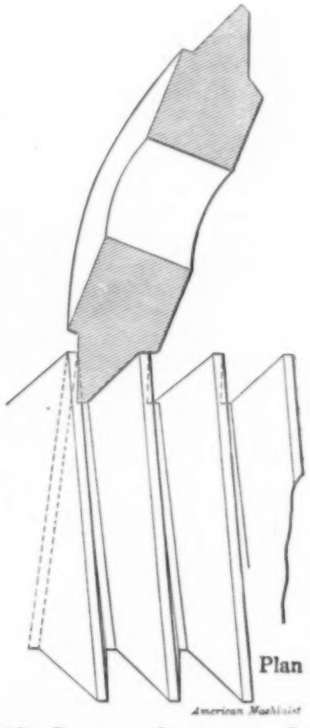


FIG. 15. PLAN OF SCREW AND CUTTER SHOWING CUTTER AXIS SWUNG AROUND IN HORIZONTAL PLANE AND ALSO TILTED IN VERTICAL PLANE

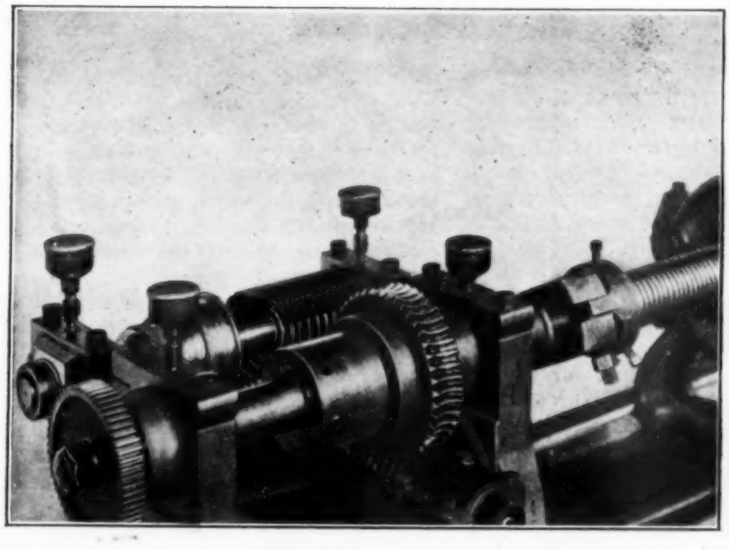


FIG. 13. HEAD OF LATHE CONVERTED INTO THREAD MILLER

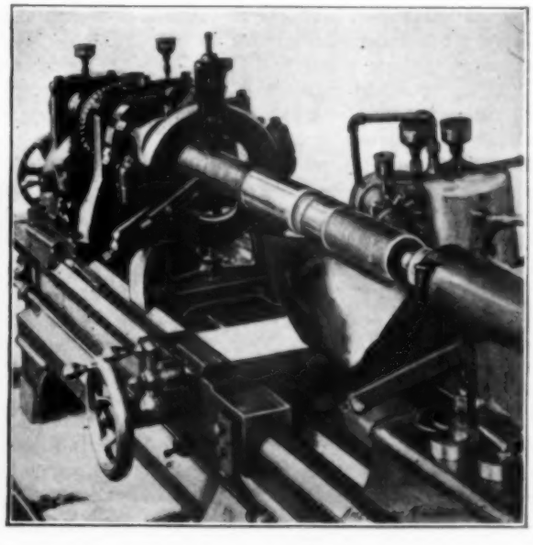


FIG. 14. END VIEW OF THREAD MILLING LATHE

drops slightly, and is supported by the backs of the knife-edge fulcrums which then rest upon the pair of blocks shown. When pressure of the jack is applied under the beam, the knife edges are lifted into contact with blocks in the under side of the opposing saddle, about which the beam fulcrums.

The beam is graduated to give in tons the lifting effort required at different points along its length to raise the maximum load of 5600 pounds suspended at the outer end of the beam. By placing the jack under the graduation representing the desired number of pounds, it may be tested for any load. It is customary to test the jacks up to at least twice their rated capacity to determine if there is any indication of weakness in any of their parts, and any signs of failure under this double load causes the rejection of the jacks.

The testing machine also provides a convenient means of comparing jacks, one type with another, and of determining the reliability of a jack's rating. With a fixed leverage, the jack should lift a certain weight, with a given pressure on the lever, and the apparatus shown makes it easy to establish by practical tests the accuracy of the rating.

A Heavy Shop Truck

The truck in Fig. 17, is a convenient vehicle for carrying such material as parts of jacks about the shop. It is a regular platform truck, with a four-shelf case secured permanently in position. The truck illustrated is used for handling heads for hydraulic jacks.

The Critical Points of Steel

By C. U. Scott

It has been my privilege to visit several shops of late and invariably conversation has drifted to the critical points in heating steel for hardening, and several have felt that they were placed at a disadvantage from the fact that they were unable to determine all of these points, but before proceeding further let us understand what these points really are. In the heating of a tool or piece of carbon steel, the steel becomes hotter in accordance with the amount of heat being applied until the steel reaches about 1350 degrees Fahrenheit, when the pyrometer ceases to record any rise in the temperature of the piece being heated, and when the heat is being applied at the rate of 1500 degrees for 5 minutes; this stationary temperature has a duration of about 10 seconds, which causes a jog in the heat curve. After this point is passed the pyrometer will again indicate a steady rise in the temperature, the commencement of which is termed the calescence point, calescence meaning to grow warm or increasing heat. If the piece is next removed to a cooling chamber, with the fire end in place, as the piece cools there will be noted another slight jog in the cooling curve close to 1235 degrees, which is the recalescence point, recalescence meaning: reglow or renewed calescence.

The non-magnetic point is a point but a very few degrees above the calescence point which needs no further explanation other than the name.

Critical Points Useless to Hardener

I have for several years been experimenting with the above points and I am now able to say, without fear of being successfully contradicted that they are of no use to the tool hardener or steel treater or even the forging department.

The "critical" point, to me, means the exact heat for the piece to be hardened and this critical point means the same to the hardener as does the finish cut to the machinist.

Let us consider the true records in this matter. First, if we take a piece of steel 1/16 inch thick and determine the proper heat for quenching we will find when the true worth of the tool is considered, that the proper heat is nearly 120 degrees above the non-magnetic point, which is higher than the calescence point; hence of what value can either be when we are obliged to establish the proper heat for quenching by the grain of the steel? Next, if we take a milling cutter of the same steel, except say 2½ inches in diameter, we will find that the proper quenching heat for the milling cutter will be close to 1480 degrees, 180 degrees beyond the calescence and 76 degrees beyond the non-magnetic points, which are 1300 degrees and 1404 degrees respectively. Could either be of any value to the hardener? Of course not, nor could steel be successfully forged at either of these heats.

Now let us turn to the water-hardening or fast-finishing steel and we find the calescence and non-magnetic points to be very low, and we also find an excellent grain if hardened from either of the points, for this steel, no matter when it is broken shows a fine grain unless overheated. We find its calescence point at 1292 degrees and its non-magnetic at 1375 degrees, yet the range of the heat required for this steel in the hardening runs from 1425 degrees to 1690 degrees. Where could either of the above points be of any value in the hardening of tools?

The Points in Non-shrinkable Steel

In the non-shrinkable steel, which so many consider a joke, we find the above points very low, yet close to the regular range, being 1290 degrees for the calescence and 1380 degrees for the non-magnetic points, yet this steel can and should be hardened at a heat between 36 degrees below the non-magnetic point and 60 degrees above the calescence, though the range of hardening heat runs as high as 1435.

Facts and Figures Taken from Experience

Before leaving this subject I wish to assure the reader that the above information is taken from actual experience and in a furnace where a positive heat was taken for each test. The real value of the calescence point is in making physical tests of steel for comparative results. The calescence point appears in all classes of steel in about the same place, the only difference being in the length or duration of the calescence point, the point being found in order to establish or determine the annealing heat, the annealing heat in testing being usually 15 degrees above the calescence point, but it should not be less than 10 degrees nor more than 20 degrees above the calesence point in any case.

The recalescence point is of no value other than to help prove the calescence point and the calescence point is not reliable, for much depends on the previous treatment of the steel as to whether it appears at the same reading or not, for example: to first find the calescence point, then heat the piece to the hardening heat and cool in brine, means to reduce or lower the point at which the calescence point will again appear. As far as I know all laboratories are using this point to determine the annealing heat and while it is very good I do not consider it as valuable or as reliable as the non-magnetic point and it is my opinion that we will soon take the non-magnetic point as a standard to test from, rather than the method we use now from the fact that it is non-changeable, for I have not been able to disturb its position in the least.

Only Non-magnetic Point in High-speed Steel

I nave often been asked regarding the recalescence of high-speed steel. I must say that as yet I have never been able to observe any point in the heat curve of high-speed steel either in heating or cooling and it becomes non-magnetic nearly 900 degrees below the proper hardening heat.

In conclusion I would say to all who want to succeed in hardening and heat treating of steel: Study it in all the operations and determine why one piece of steel gets shorter and another gets longer in the cooling and this will mean that we are studying the two natural laws which contain the regulation of the safety valve for all hardening; determine your heats by the grain and the amount of heat required to soften the tools being hardened; learn when a tool has become sufficiently hardened and learn to quit hardening at this point. Give me a piece of steel and tell me what is in it and I will treat it and be as sure of the full strength of this steel as the machinist is of his driving fit, though this can only be done with a positive fire and a reliable pyrometer.

Two Punch Press Attachments

Special Correspondence

A special table for feeding sheets in "zigzag" in a double-action cutting and drawing press, and an electrical alarm device with a dial feed that rings a bell when more than one blank is fed by the operator.

Two ingenious punch-press attachments, built by the E. W. Bliss Company (Paris), are shown and described in the accompanying illustrations and text.

Special Table for "Zigzag" Feed

This press is specially designed for simultaneously cutting and drawing such pieces as lamp sockets, burner parts, cartridge shells and similar drawn pieces in brass or steel.

By means of the division table shown, sheets of metal up to 56 inches long by 28 inches wide may be worked up without any preliminary squaring, slitting or shearing, and in such a way as to effect the greatest possible saving of metal, by punching in zig-zag form, one cut almost touching the other, the accuracy of division being practically perfect without any skill on the part of the operator, and at a speed which far exceeds that of feeding by hand. The saving of stock ranges from 8 to 35 per cent., according to circumstances.

With the press shown in Fig. 1, 50 to 110 strokes per minute may be utilized according to the skill and diligence of the operator. The carrier is moved sideways (toward right or left) by the handwheel shown in front, and its advance is automatically stopped at each stroke so as to present the sheet in the exact position required for punching the next blank. At the end of each row of punchings, the sheet is advanced one division toward the die by means of the larger handwheel (shown beneath the table). These handwheels as well as the clutch treadle are so located that the operator can remain seated or standing in one position while cutting up the entire sheet. The sheet is fed with greater accuracy than would be feasible in any other way, thus reducing the waste to a minimum and securing the proper position without any special skill on the part of the operator, besides obviating all preliminary trimming or shearing.

Each cutting diameter calls for a suitably divided rack to control the side motions, but one and the same indexing bar may be used for five diameters, by adding suitable holes, for controlling the spacing toward the die.

The scrap is automatically cut up and separated from the stampings at each stroke by means of a device placed behind the die. The sheet is clamped in the carrier by one motion of a handle.

The operator need never, while operating the press, get anywhere near the die, so there is no danger to his hands.

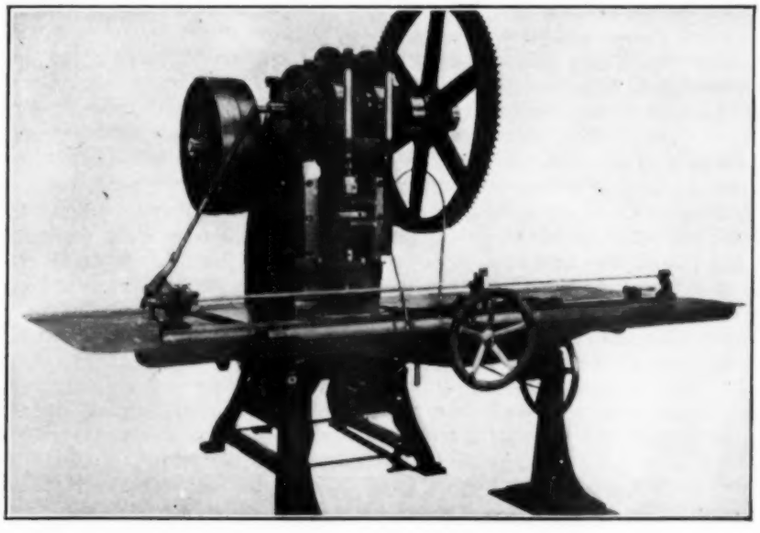


Fig. 1. Special Punch Press Table for "Zigzag" Feed

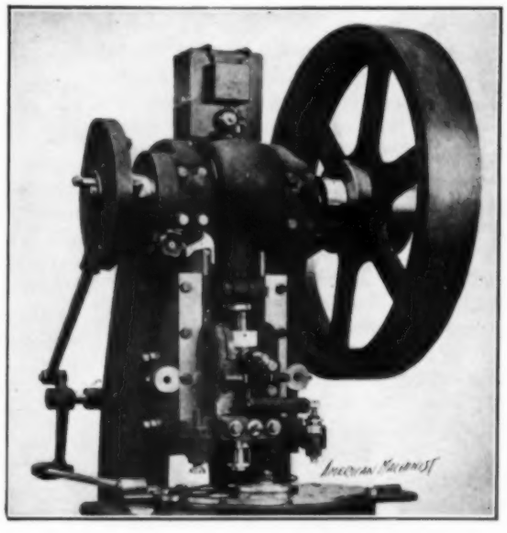


Fig. 2. Electric Alarm Attachment for a Dial Feed

Dial Feed and Electrical Safety Device

This machine has been specially designed for stamping or cupping blanks previously cut. In the case of such blanks, if they are fed into an ordinary press by hand, there is danger to the fingers of the operator and, moreover, it is practically impossible to prevent, occasionally, two blanks being fed simultaneously under the die. A dial-feed press has been recognized as the most suitable arrangement for obviating the risk of hurting the fingers of the operator, but with a dial feed the danger of placing in several blanks at once is even greater because, owing to the automatic action of the machine, the operator cannot as easily as is the case of a hand-fed press, perceive the fact of having put in several blanks.

To avoid this difficulty, this machine is furnished with an electric device (shown in Fig. 2 at the right on the slide of press), which embodies a gaging pin so set as to allow a normal thickness to pass beneath it. If there is more than a normal thickness, owing to the presence of several blanks or to the stock being too thick, the gaging pin causes the electric bell, connected with a battery on top of the press, to ring. This bell continues to ring until the press is stopped. The operator can easily remove his foot in time as the electric contact commences several strokes before the blank reaches the point where it is to be operated on. The superfluous blanks are then readily removed and the danger of choking the die and straining the press is thus obviated.

The machine in this shape is specially useful for utilizing waste blanks, such as come from filler-hole lids, curtain rings, etc., and which are to be transformed into boxes, caps and cups. These waste blanks, owing to their curved or burred edges, have a strong tendency to stick together, making it difficult to separate them and thus increasing the danger of getting several into the tools.

Standard Test Conditions for Files

By Edward G. Herbert *

The three qualities to be determined are durability, efficiency and uniformity.

It is possible to determine these only relatively among different files, so a standard set of test conditions is essential to obtain comparable results.

Factors which alter the results and so determine desirable test conditions.

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The system of mechanical testing has now been very generally adopted in connection with large file contracts, but file manufacturers often have been placed in a difficult position owing to the diversity of conditions under which their files have been tested. Several standard tests are now in use and others have been proposed. It is to the interest of all parties that there should be uniformity in the conditions of the test, and it therefore seems desirable to review the essential requirements for a standard file test.

In the first place it should be clearly understood that the file-testing machine does not and cannot determine how much work a file will do in the hands of a workman. The testing machine draws a diagram showing how many lineal inches the file has removed from a bar of steel or other metal, which is pressed against it with a uniform pressure while the file is reciprocated through a stroke of constant length. The diagram shows also the number of strokes made and the rate at which the bar was filed away. But the workman does not move his file through a constant stroke, or exert a constant pressure, or file a uniform material; and his work cannot be measured in inches of metal filed away or by the number of strokes made. File tests are purely comparative; their only function is to compare the quality of one file with the quality of another, or of files in general, as shown by their performance under identical conditions on the file-testing machine. It follows that any statement as to the number of inches a file or make of file will remove, or as to the number of strokes it will make, is meaningless and conveys no information as to quality unless it is known what were the conditions of the test, and what the best or the average file would do if tested under identical conditions.

The variable conditions of the test are: (*a*) The number of strokes per minute; (*b*) the length of the stroke; (*c*) the pressure of the test bar against the file; (*d*) the section and physical properties of the test bar.

(*a*) The testing machine is usually run at 50 strokes per minute. At this speed a quick-cutting file becomes considerably heated, but there is no reason to suppose the temperature ever rises high enough to injure the temper of the file. Any considerable increase of speed, however, undoubtedly would lead to this result and is, therefore, undesirable. It is obviously undesirable to run the machine slower, as this would increase the duration and cost of the tests.

(*b*) The full stroke of the machine is 6 inches and this stroke can be used in testing files from 10 to 16 inches in length. It is desirable to test all files as far as possible on the same stroke, as the test then gives a measure of quality independent of the size of the file. Files less than 10 inches long are tested with a stroke of 3 inches.

(*c*) A pressure of 30 pounds was originally adopted as being equivalent to the force with which a workman can press his file against the work when filing by hand. It may be retained as a convenient pressure for use in testing; but it should be recognized that it is purely arbitrary and has no real connection with the pressure exerted when filing by hand, since the workman rarely files on a flat surface exactly 1 inch square and, therefore, rarely exerts a pressure of exactly 30 pounds per square inch of contact. He may exert a pressure of a few ounces or of many hundreds of pounds per square inch.

In testing on soft materials it is necessary to use a less pressure. A preliminary test of 5000 strokes is commonly made on annealed cast iron to show the efficiency of the file for use on cast iron. A pressure of 15 pounds is used for this test. If a heavy pressure is used on a soft material, all files with the same size of teeth, whether good or bad, are found to cut at approximately the same rapid rate and the test does not serve to distinguish between them.

(*d*) The principal divergence in the testing conditions has arisen through differences in the composition and heat treatment of the test bars used. The makers of the testing machine have for some years employed a steel bar made for the purpose by Messrs Vickers Sons & Maxim, Ltd., of Sheffield. The analysis of the "Vickers Bar" is as follows:

C 0.63 Mn 0.33 Si 0.247 S 0.031 P 0.021

It receives a heat treatment which gives it a hardness represented by No. 224 on the Brinnell system. It is made in lengths of 4 feet and is planed to a section of 1 inch square. It will be convenient in studying the requirements for a standard test to consider how far this standard bar meets the requirements and in what way the usefulness of the test is affected by departures from the conditions which have been adopted by the makers of the testing machine. Tests on the Vickers bar 1 inch square with 6-inch stroke and 30 pounds pressure will be referred to as "standard tests."

The qualities to be determined by the file test are: (1) Durability; (2) Efficiency; (3) Uniformity, as between the respective faces of the same file and as between individual files of the same make.

The standard test must be capable of measuring all these qualities with a moderate expenditure of time and material.

Durability

This is determined by the number of lineal inches which the file is capable of removing from the standard test bar before becoming too blunt to cut under the conditions of the test. When this condition is reached, the file slips over the surface of the bar and the test is at an end.

It may be objected that a workman rejects a file before it is quite incapable of cutting and that the standard test should, therefore, be brought to an end before this limit is reached. A moment's consideration will show that this objection is not valid. Suppose a file to be tested on a steel bar under a very light pressure, say 5 pounds. Unless the file is unusually sharp it will slip over the surface of the bar without cutting. It will be entirely unaffected by the test. Under a rather heavier pressure it will cut until the keen edge of the teeth is slightly dulled and will then cease to cut, but will be to all intents and purposes a new, sharp file. Under still heavier pressure it will continue cutting for a considerable time and will then slip, but it may still be capable of a great deal of work. Tested under a very heavy pressure, it will continue cutting until the teeth are almost entirely worn away. From this it is clear that a file which has ceased to cut under test is not necessarily blunter than it would be when rejected by a workman. The degree of bluntness depends upon the pressure used and on the hardness of the bar. As a matter of fact, files which have ceased to cut under 30 pounds pressure on the Vickers bar are not completely worn out, but are capable of doing more work.

Is it not possible, then, to arrange the

test so that the files are completely worn out? The answer is that it is possible but unnecessary. The files can be completely worn out by testing them under a heavier pressure, or on a softer bar. In either case they will continue cutting until they have reached a further stage of bluntness.

A durability test on a soft bar is too costly for practical purposes. A good file will remove more than 20 inches of the Vickers bar under standard conditions, and make more than 100,000 strokes. The duration of such a test is more than 30 hours, and there is no reason to believe that the limit of durability of files has been reached. On a softer bar, files have been tested for weeks before they ceased to cut. The same objection applies, but in a less degree, to tests on the standard bar with heavier pressure and there is the additional objection that a very sharp file if heavily weighted is liable to have its teeth broken. This may be obviated by increasing the pressure in stages. On completion of the test with 30 pounds, the pressure may be increased to 60 pounds; the file will recommence cutting and continue until it is further blunted, when it will again slip. This continuation test may be as long or longer than the first; a very serious addition to the cost, and it will not give any additional information of value. The test under 30 pounds serves to distinguish good files from bad ones and the continuation test is found merely to confirm it. The additional work done by a bad file is less than that done by a good one. The continuation test, therefore, adds to the cost without serving any useful purpose.

Is it possible to shorten the durability test? It may be shortened by using a lighter weight or by using a harder bar. Either course is open to a serious objection: Under the standard test a very poor file will make some kind of a record, but with a lighter pressure or harder bar a certain proportion of files would not cut at all. The test would no longer be available for comparing rather poor files and this it often is required to do.

Thus it appears that the conditions adopted meet all the requirements of a standard durability test, and that no considerable departure can be made from these conditions without serious drawbacks. Under these conditions the average amount of steel filed away by two sides of a file is 5 inches and the average number of strokes 33,000.

Efficiency

The efficiency of a file is shown by the slope of the test diagram and is measured in inches filed away per 10,000 strokes. The file may be judged by its efficiency at the commencement of the test, before it is at all worn; by its average efficiency, taking the whole of its life into account; or by the number of inches filed away in a fixed number of strokes, say 20,000 or 40,000. Of these the first method is the most convenient for various reasons. The average efficiency, though apparently the best measure of the cutting capacity of the file, is open to this objection; that a file which abruptly ceases cutting soon after the beginning of the test, will have a higher average efficiency than one which was equally efficient when new but which had a much longer life with a gradually decreasing efficiency. The better file would show the lower average efficiency. The third method is not universally applicable, since files not infrequently fail before making even 10,000 strokes.

The rate at which a given file removes metal depends upon the hardness of the test bar and on the pressure used. On the standard bar, with 30 pounds pressure, the efficiency of new files varies from ½ inch or less to 8 inches per 10,000 strokes. With a harder bar or a lighter pressure, some files will not cut at all and their efficiency cannot, therefore, be measured. With a softer bar or a heavier pressure, all files cut faster. Unless the pressure or the softness of the bar are excessive, it is still possible to measure efficiency; but, as stated above, the duration and cost of the test become excessive. Hence, the adoption of too soft a bar has sometimes led to the practice of judging files by their efficiency alone, the test being stopped (to save expense) before the file is appreciably worn and the quality being measured by the number of inches filed away in a fixed number of strokes, usually 20,000 or 40,000. Since the efficiency of a file before it is appreciably worn depends entirely upon the formation of the teeth and is independent of the quality of the steel of which it is made, this practice tends to encourage the production of well cut files of very poor steel. A test which ignores durability cannot be considered satisfactory.

This method of testing is open to a further objection. It is possible to cut files so that they are too efficient for convenient use. They grip the work too keenly and cannot be used by hand without undue exertion. In the power-driven testing machine such files show a very high efficiency. It is evident then that when files are judged by efficiency alone, the "best" file may be one which cannot be conveniently used and which may be of such a poor quality of steel as to possess little lasting power. A more useful and more durable file may be condemned in comparison. The maximum useful efficiency has not yet been settled, but it probably will be found in the neighborhood of 6 inches per 10,000 strokes on the standard test bar.

Uniformity

It is a well known fact that considerable variation often exists between the two sides of the same file and between files of the same make. Absolute uniformity is no doubt unattainable, but it is pertinent to ask what percentage of variation is unavoidable in carefully made files, and, therefore, permissible. The answer is that the percentage of variation between any two files depends entirely upon the conditions of the test. An illustration will make this clear. A workman capable of exerting a pressure of 30 pounds has two files, one sharp and the other rather blunt. He tries them on a broad surface, such as a lathe bed; the surface of contact of the file with the work is large, say, 10 square inches, and the effective pressure is, therefore, three pounds per square inch of contact. Under these conditions the blunt file slips over the work without cutting; such a light pressure is insufficient to cause the teeth to penetrate the metal. The sharp file cuts freely. According to this test the ratio between the two files is 0 to 1; the sharp file is infinitely better than the blunt one. The same two files are now tried on a surface 1 inch square; the effective pressure is 30 pounds per square inch. The blunt file now cuts fairly well, but the sharp one perhaps twice as fast; the ratio is now 1 to 2, the sharp file is twice as good as the blunt one. The test is repeated on a narrow surface, say, 1/10 inch wide by 1 inch long. The effective pressure is now 300 pounds per square inch. Both files now cut very well; both have their teeth filled with metal at each stroke and it is impossible without reducing the pressure to distinguish between them. With an alteration in the conditions of the test the ratio has changed from one of infinity to one of equality.

Exactly the same thing occurs on the testing machine. Tested with a very light pressure one side of a file may entirely fail to cut, while the other cuts well. Increase the pressure and the two sides will show a less variation, say, 30 per cent.; test the same file with very heavy pressure and the two sides will appear equally efficient. What applies to the two sides of a file applies equally to different files by the same or different makers. Thus it is easy to arrange a test which will show all files alike and all efficient. This may be done by using a very heavy pressure, by using a bar of small section with a moderate pressure, or by rocking the file so that it bears on only a portion of the bar surface. Such a test is, of course, useless for discriminating between files. It shows neither their relative efficiency nor their uniformity and, as it is necessarily a test of long duration, it is unsuitable for testing durability.

The test on the Vickers bar shows some variation between the most carefully made files. Great improvements recently have been made in the matter of uniformity by manufacturers who have studied the problem, but perfect uniformity cannot be expected. It is desirable that the buyer and the maker should have a means of testing uniformity; but it is only by observing what degree of uniformity actually has been attained under given testing conditions, that the buyer can decide what degree of uniformity can fairly be demanded.

In drawing specifications for files, it is important that durability, efficiency and uniformity should all be taken into account. The following is suggested as a suitable form of specification:

X per cent. of files to be tested on Vickers bar 1 inch square with 30-pound pressure, 6-inch stroke, 50 strokes per minute. Files to remove an aggregate of not less than *Y* inches of bar with the two sides before ceasing to cut. The efficiency of files when new to be not less than 2, nor more than 5 inches per 10,000 strokes. These requirements to be fulfilled by not less than *Z* per cent. of the files tested.

Professor Ripper's Modification

It is necessary briefly to refer to a modification in the file-testing machine, proposed by Prof. W. Ripper, of Sheffield University. This attachment, which has been described in the American Machinist, is designed to alter the inclination of the file to the test bar after each cutting stroke. In addition to being tilted bodily in a horizontal plane, the file is rocked about its own axis and in the course of each cycle of movements it takes up 48 distinct positions.

Whatever may be the effect of these changes of position on the cutting action of the file, it is evident that the magnitude of the effect must depend upon the angle through which the file is tilted. This angle is different for each length of file. The testing machine deals with files from 4 inches to 16 inches in length; the stroke of Professor Ripper's eccentric is ⅛ inch in all cases; therefore, the angle of tilt varies from ⅛ inch in 4 inches, to ⅛ inch in 16 inches. With this attachment in use it would no longer be possible to compare the results produced by files of different lengths; or, in the case of specifications for file contracts, to lay down a single standard to which all files of the same cut must conform. There must be a distinct standard for each length of file in each of the various cuts.

Some still more serious objections have to be noted. The effect of tilting the file is to cause it to bear on a portion only of the bar surface and this raises the effective pressure per square inch of contact. Some disadvantages of testing under a high effective pressure have been already pointed out; viz, increased duration of tests and the tendency to equalize results from blunt and sharp files. These disadvantages occur even where the increased pressure is constant; but with Professor Ripper's attachment in use, the effective pressure is variable and the variation is such as to exaggerate these disadvantages.

The effect of tilting and rocking the file is to cause it to bear at the beginning of each cutting stroke on an edge or a corner of the test bar. At the end of the cutting stroke the file has formed a flat on the end of the bar. Therefore, the effective pressure per square inch of contact varies from a very high value at the beginning, to a lower value at the end of each stroke, and each portion of the file is tested under a different pressure.

Further, a very sharp and efficient file may form a flat extending right across the end of the bar; in this case the effective pressure at the end of the stroke is 30 pounds per square inch. A less efficient file will form a flat equal to half the area of the bar and the pressure at the end of the cutting stroke will be 60 pounds per square inch. In the case of a very inefficient file the flat will be very small and the effective pressure much higher. It is clear, then, that with this attachment in use bad files are tested under heavier pressure and, therefore, under more favorable conditions than good files. That there should be increased uniformity in the results given by good and bad files, whether by the same or by different makers, is only to be expected and this, apparently, is claimed as an advantage. It might indeed save some trouble to makers whose files are not uniform, but it should be borne in mind that the function of the testing machine is to distinguish between good files and bad; between those that are uniform and those that are not. Any alteration in the testing conditions, which secures uniformity of results by favoring bad files, lessens the utility of the testing machine, at the same time renders it easier for bad files to compete with good ones and more difficult for the maker of high-class files of uniform quality to obtain a good price for them. For these reasons the makers of the testing machine are compelled to regard Professor Ripper's attachment as quite the reverse of an improvement.

50 Years in the Steam Pump Business

By an Old Timer

Referring to the multiple water valves for each pump chamber, it seems strange that this important invention of Mr. Worthington's was not thought worthy of patenting. It was soon adopted by marine engineers for the air pumps attached to the main engines of all steamships, and has been the practice to the present day.

Previous to this, the air-pump buckets had each two large valves, half-moon in shape, and they thrashed themselves to pieces every trip across the ocean.

The success of the Worthington pump on the steamer "Washington" somehow so completely identified it with the name of the ship, that for years afterward it was common among marine engineers to call all Worthington pumps "Washington pumps," and the habit nearly obliterating the real name. Many an order came in for a "Washington pump."

The side pipe and readily accessible strainer held its own, and it was no longer necessary to wrestle with a clogged strainer on the lower end of a suction pipe in the bottom of a ship, where all refuse accumulates. Many a ship has been lost by the choking up of the pump suction pipes in the bilge.

Development of the Water Meter

Somewhere about 1850-51, Mr. Worthington's attention was drawn to the public necessity of a good, reliable and inexpensive water meter; he began to study the problem. The first first one he produced was a single cylinder, mounted on a trunnion underneath the center. This trunnion was a cylindrical slide valve, or plug cock, with parts to suit that connected to each end of cylinder. The piston was solid, 3 inches in diameter by 4 inches long, and had about 10-inch stroke, and its weight on the ascending stroke caused the upper end of the cylinder to fall to an angle of 45 degrees. The water admitted to the lower end drove the piston up again and caused the other end to fall. The piston was free and simply traveled from head to head, giving correct displacement of water at each stroke. The usual counter was operated by its motion. But it was intermittent in its water delivery, cumbersome and exposed to leakage and cramping on its valve trunnion, although correct in its measured delivery.

The next study produced the duplex water meter with four cylinders in one casting and a cavity in the middle for a slide valve. It took a few years of study and experiment to bring about the cylindrical floating plungers running through rings, so that they really floated like a chip of wood on the tide, and would make full stroke and measure water correctly on two or three inches head above the top of the meter. It took years to overcome the popular prejudice against all water meters, but eventually hundreds of thousands were made, and are still being made.

Rise of the Duplex Pump

This little machine was the parent of the duplex steam pump, which has revolutionized all pumping machinery in the

world, and stared its inventor in the face two or three years before it obtained recognition. The first one put in practice was built in the early part of 1857, and placed in the old St. Nicholas hotel, New York, followed later by a larger pump for the Fifth Avenue hotel, and afterward one for the Continental hotel, Philadelphia. These machines were each made up of two of the old-style relief-motion steam pumps, standing end to end, steam cylinder heads facing each other, the valve of each one passing through its own steam chest, and operating the slide valve in the other. There were no water-relief holes in the plungers.

These pumps delivered water to every part of the hotel without the least noise, something that had never been done before. This was really a great achievement, and one that had something to do with the success of hotels and the comfort of their guests.

Bolts for Shaft Coupling

By James H. Carver

In the design of couplings secured with bolts, it frequently is desirable to question the shearing strength of the bolts, which should be strong enough to withstand all of the stress put upon them by the shafts that the coupling connects. The following shows a method of derivation of formulas necessary to determine the several terms under different conditions:

The drawing shows a flange coupling where d = diameter of bolts, D = the diameter of shafts, R = radius of bolt circle and N = number of bolts used. Moment of torsion about shaft center = Pa, where P = load and a the arm. In the investigation of shaft strengths the moment of resistance to this twisting is found to be $\frac{\pi}{16} D^3 S$. Where S = unit shearing stress used. Moment of torsion = moment of resistance, or $Pa = \frac{\pi}{16} D^3 S$. Shearing resistance of bolts = $\frac{\pi}{4} d^2 NS$. Moment of this resistance about radius R is $\frac{\pi}{4} d^2 NSR$. Having shafts and bolts of equal strength makes $\frac{\pi}{4} d^2 NSR = \frac{\pi}{16} D^3 S$, then

$$d = \tfrac{1}{2}\sqrt{\frac{D^3}{NR}} \qquad (1)$$

or

$$N = \frac{D^3}{4 d^2 R}. \qquad (2)$$

If radius of bolt circle or diameter of shaft is needed, solve for R or D, as the case may be.

The resistance to twisting moment Pa can be found in terms of horsepower, and n (number of revolutions per minute).

A load of P pounds at a radius of a inches and revolving at n revolutions per minute, is equal to

$$\frac{P 2\pi a n}{12 \times 33{,}000} \text{ horsepower;}$$

or

$$Pa = \frac{H.P. \times 6 \times 33{,}000}{\pi n}.$$

As before, let Pa equal moment of resistance to shear of bolts about radius R (for equal strength), then

$$\frac{H.P. \times 6 \times 33{,}000}{\pi n} = \frac{\pi d^2 NSR}{4};$$

or

$$d = 283\sqrt{\frac{H.P.}{nNSR}}. \qquad (3)$$

Formula (3) gives d in terms of horsepower, number of revolutions per minute, number of bolts, unit shearing stress and radius of bolt circle. From the above,

$$N = \frac{80{,}251\ H.P.}{n d^2 SR}. \qquad (4)$$

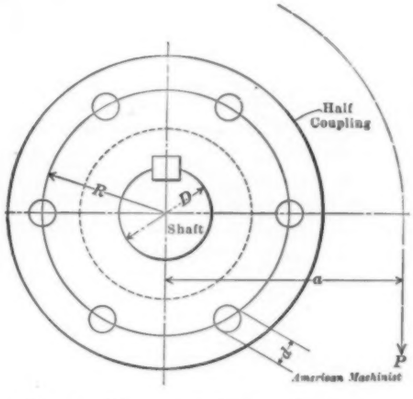


Fig. 1. Bolts for Shaft Coupling

Other terms may be found from (3) or (4).

Examples

A gear whose pitch diameter is 18 inches, is connected to a 2-inch shaft and one-half of a flange coupling, the gear taking the place of the other half. The bolt circle in gear and coupling is 4 inches in diameter. Find the diameter of bolts when 6 bolts are used.

Using formula (1), $D = 2$, $N = 6$ and $R = 2$.

Then

$$d = \tfrac{1}{2}\sqrt{\frac{D^3}{NR}} = \tfrac{1}{2}\sqrt{\frac{8}{6 \times 2}} = \tfrac{1}{2}\sqrt{\frac{2}{3}} = 0.4,$$

nearly, say ½ inch diameter. The conditions being the same, to find the number of ½-inch bolts necessary, by formula (2)

$$N = \frac{D^3}{4 d^2 R} = \frac{8}{4 \times \frac{1}{4} \times 2} = 4$$

bolts would be safe. An air-compressor direct connected to a 20-horsepower gas engine running 200 revolutions per minute, by a flange coupling with four bolts on a 4-inch circle; to find diameter of bolts, using formula (3)

$$d = 283\sqrt{\frac{20}{200 \times 4 \times 6000 \times 2}} = 283 \times \frac{1}{693} = 0.409,$$

nearly; say ½-inch bolts.

A Drawing Table for Several Men

By F. M. Porter

The department of civil engineering of the University of Illinois has designed and adopted a unique drafting table, a brief description of which is appended. The features that are most original are the natural result of suggestions arising from regular practice in the drafting rooms of the department. It is thought that a desk of this type may appeal to the needs of similar drafting rooms, as well as to those of the commercial office. In other words, wherever it may be desired to work several men, at different times, at the same table. The advantages enumerated are evident:

The desk is made with a tilting top of wide range. It is hinged at its front edge, and is held firm at any angle up to about 60 degrees by means of an adjustable brace at the back.

There are locked apartments to accommodate four draftsmen; each apartment consists of a receptacle for a board, and a drawer for the smaller instruments. Each compartment may be locked individually, the board space being automatically locked shut when the drawer is closed. The board space is a unit, and may be easily omitted from the table if desired.

Boards of any size or proportions up to 26x38 inches may be used.

Parallel rules or T-square may be used, the pulleys and wires being concealed and protected. Any standard type of "universal" will operate successfully with it. Further, attachment would be made to the tilting top, so that one instrument could be used over a number of boards.

The body of the desk is well up from the floor, making it much easier to clean beneath it. The board lockers are open at the bottom, so that small articles, such as pencils, etc., if accidentally dropped inside will pass through to the floor.

The desk is of proper hight to be worked either standing or with a stool. The usual foot-rest is provided.

The late Lord Kelvin is said to have held the theory that radium acts as a transformer of some form of ether force into some other form, and that the process of transformation produces heat and light. This he based on the general hypothesis that energy is always necessary for the production of heat or light.

The Different Kinds of Jigs*

By Lucian Haas

Giving a large variety of jigs and fixtures for making different kinds of work, from the simple drilling plate to the elaborate, built-up, indexing fixture.

Some of these are sure to suit almost any kind of work and the proper type of jig can be easily made from these sketches.

The jig shown in Fig. 1 is generally classed as a temporary jig. It is located on a casting by means of two or more locating pins and is held by a clamp, while the holes are being drilled.

For small jigs the plate *A* is often made of steel, and instead of having bushings this plate is drilled out to suit the drill to be used, and then it is case hardened, after which the holes are lapped and the locating pins driven in place. They are more frequently made of cast iron, in which case the locating pins are hardened and the standard form of bushing used.

Fig. 2 is an open-face jig, and generally used for flat work. The part enters the front of the jig and is forced against the locating points *B* by the screw *C* and held down by the screw *A*. For removing the part, a hole *D* can be placed in the back of the jig, through which the operator can enter a screwdriver or round piece of stock, and quickly work the part out.

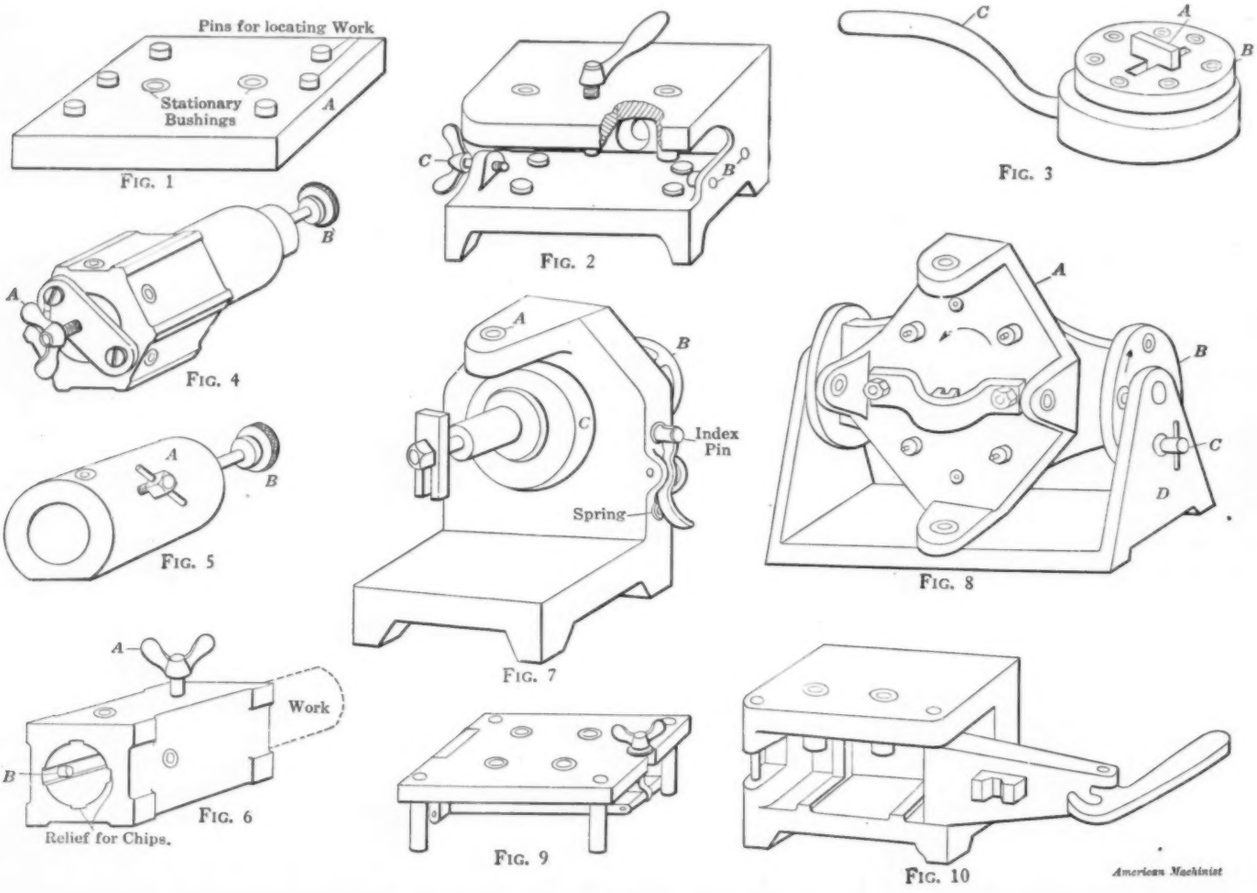
Fig. 3 shows what is generally called a pan jig, and is used for drilling small plates and it also demonstrates the use of handles on jigs. The handle *C* acts as a quick means for moving the jig about and holds the jig while the screw *A* is being tightened. The plate *B*, which contains the guide bushings, acts as a clamp and is removable when a screw *A* is turned half way around.

Fig. 4 may be called a hex jig and is used for drilling hex head bolts, nuts, collars, etc. The illustration shows a jig designed for drilling wrench holes around a collar. It is made of standard hexagon steel. The part is held in position by the screw *A*, and is forced out by means of the plunger *B*.

Fig. 7 shows a rotary-index jig. The part in this case may have any number of holes around the diameter and the jig is indexed to correspond. All holes can be drilled through the stationary bushing *A*. The part is fastened to the plate *C* and revolved, the indexing pin in the side does the spacing. A good-sized hand wheel *B* should be provided for turning plate *C*.

Fig. 5 is a simple design for jig for drilling work such as pins. It can be made of round steel and flattened on the bottom and provided with a knockout plunger *B*, similar to Fig. 4. The part is held in position by means of the screw *A*.

*Copyrighted 1911, by Lucian Haas.



VARIOUS TYPES OF JIGS AND HOW THEY ARE LAID OUT

Fig. 6 is similar to Fig. 5, and is often used for drilling pins, but more frequently for bar or tubing. It is made of square steel stock. The part is held in position by means of the screw *A* and is located against a stop pin *B*. The advantage this has over Fig. 5 is that one hole can be drilled at right angles with shown by arrow. *B* revolves in the cradle *D* and is held in position by the index pin *C*. This style of jig is very good for drilling large work and will be found a great help to the operator. It is very necessary that the jig be well balanced.

Fig. 9 is a table jig. The design shows expensive. When the lags are in place they are surface ground square with the plate of the jig. Legs should always be made as short as possible and their face as large as is consistent with the design. A great mistake is often made in making them smaller than the slot in the drill-press table, and also in not properly

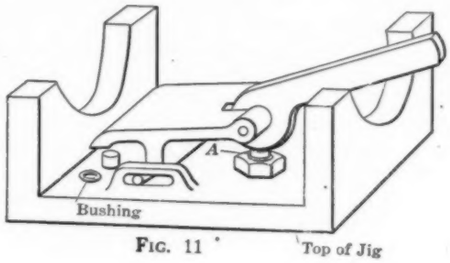


FIG. 11

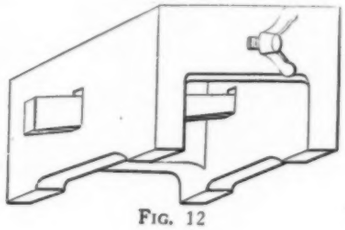


FIG. 12

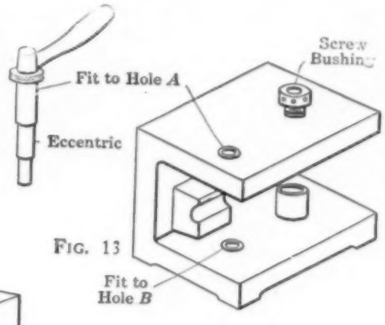


FIG. 13

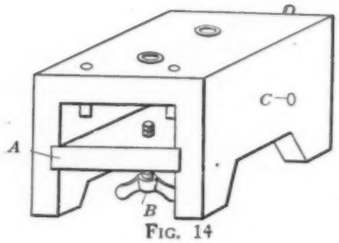


FIG. 14

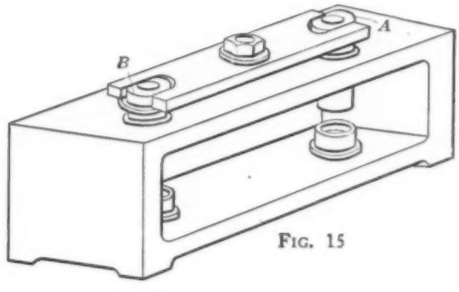


FIG. 15

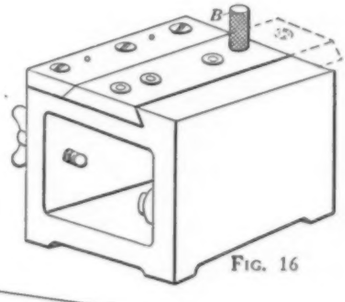


FIG. 16

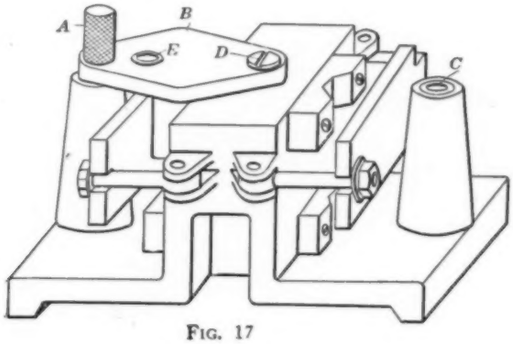


FIG. 17

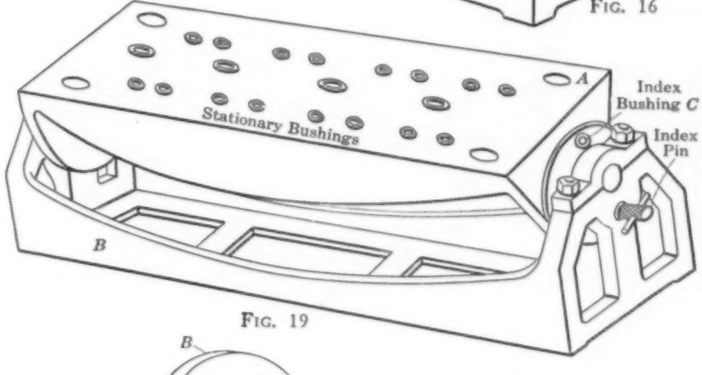


FIG. 19

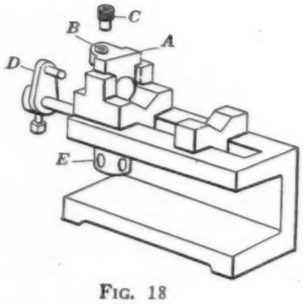


FIG. 18

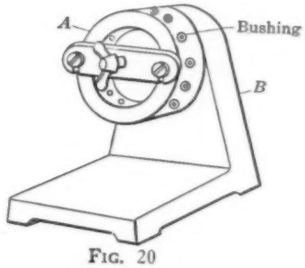


FIG. 20

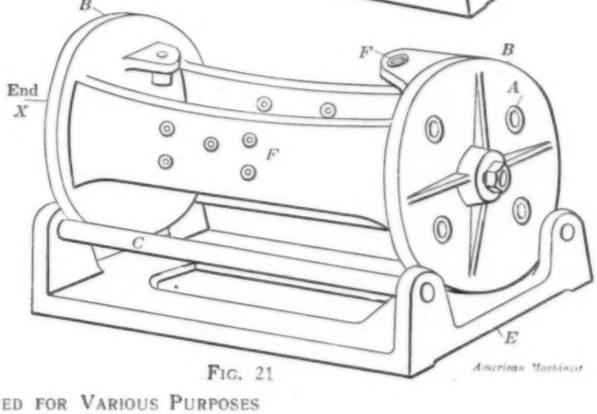


FIG. 21

OTHER STYLES OF JIGS DESIGNED FOR VARIOUS PURPOSES

another. In this design it is well to remember to relieve the jig opposite to drill bushing, to clear the bur raised by the drill and allow the piece to be freely drawn from the jig.

Fig. 8 may be called a double-acting rotary jig. The piece to be drilled is clamped in *A*, which revolves on *B*, as a built-up jig, which is generally done in a case of small work, but for large jigs of this type, it is well to have the legs cast integral with the plate. In the design shown, the legs are made of cold-drawn steel, which, when hardened, are driven in place. Some designers screw them in, but this is not necessary, and is ribbing a cast leg, or of making it too light. The work should be in all cases well clamped to the plate as the thrust of the drill is, in this case, directly against the work, and has a tendency to spring it.

Fig. 10 shows an open-end jig, but is called a hook cam-lever jig, simply to

demonstrate the use of this style of cam. It is unnecessary to describe the advantages of this style of clamping, as they are too well known. Many tool designers do not use the same style of clamping often enough, because of fear of it working loose. When they do, it is not the fault of the cam lever, but rather the design.

Fig. 11 shows another design of cam-lever jig, and for convenience it is called a standard cam-lever jig, as it is more frequently used than the one in Fig. 10. Its advantages are the same as mentioned in Fig. 10, but as a word of caution, it may be well to mention that the cam lever should not be used where there is apt to be any great variation in the part to be clamped as the cam eccentricity is not usually over 1/16 of an inch. The cam lever can, however, be used if an adjusting screw *A* is placed under the cam part of the lever, as shown.

Fig. 12 is called a wedge jig to show the use of the wedge for holding the work. It is used as often as the cam lever. Wedges, like cam levers, have only a limited amount of movement and taper, and therefore can only be used where the amount of variation in the piece is within this limit.

Fig. 13 is an eccentric-pin jig and shows how an eccentric pin is used for holding the piece. The pin in this case is shown loose, but in some instances it is held in position by means of a washer and nut. This, however, is made to suit the conditions of the jig. By making the pin loose, the work can be placed in or removed from the jig quickly.

Fig. 14 is a simple form of jig, showing the use of a sliding lid. In some instances these lids contain the drill bushings as well as clamping screw, in which case it is located by means of an index pin. The illustration shows the lid *A* used only to carry the clamping screw *B*, which holds the work to be drilled. When removing the work from the jig, the screw is released and the lid is slid out of the jig, the pin *C* acting as a stop for the lid.

Fig. 16 is called an index-slide jig, and is used for drilling a series of holes close together. The slide *A* contains the drill bushings and should be a sliding fit in the gibs. It is indexed by the pin *B*, which is removable.

Fig. 15 shows two slip bushings *A* and *B*, which hold the work as well as piloting the drill. Frequently a spring is placed under the head of these bushings so that when the pressure of the bushings is released, they will automatically rise and allow the part to be quickly removed.

Fig. 17 shows a reciprocating jig. While the work is being drilled on the left-hand side, the operator is taking out and inserting another piece on the right-hand side. The plate *B*, holding the drill bushing *E*, swings on the screw *D* and is located by means of the index pin *A* and bushing *C*.

Fig. 18 shows a jig for drilling holes in round bar stock. The capacity of this style of jig is equal to the size of the hole in the clamping slide *A*, which carries a stationary bushing *B*. In this bushing is inserted a slip bushing *C*, which is the size of the drill corresponding to the size of the hole to be drilled in the bar. A number of these slip bushings can be made up with various-sized holes. The work rests in the V's, and is located by the adjustable stop *D*. The part is held in the V's by the clamping slide *A*, a nut *E* operates this slide. The jig shown is an improvement over jigs of this character.

Fig. 19 is another design of rotary jig of the larger class. The work is bolted to the revolving frame or body *A*, which is supported by a cradle *B*. The indexing of it is done in the usual manner by means of the bushings *C* and index pin *D*; like all rotary jigs it is essential that they be in balance, otherwise the operator will have difficulty in turning it over.

Fig. 20 shows a small rotary jig. The drum *A*, in which the work to be drilled is placed, revolves in either direction on the stud, which is part of the base *B*. It will be noted in this case that the drum is not indexed, the operator, therefore has to hold it while the drilling is being done.

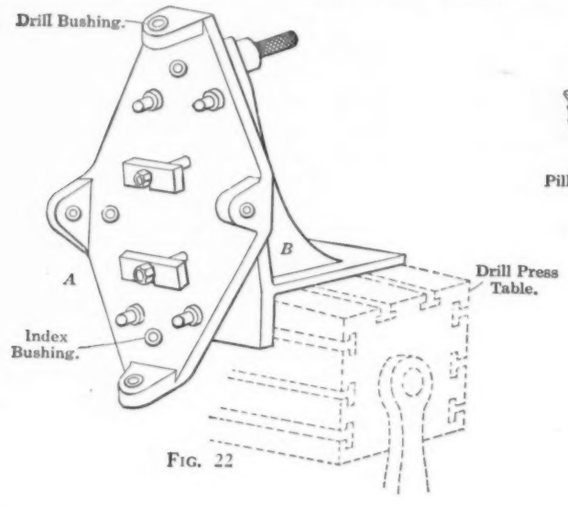
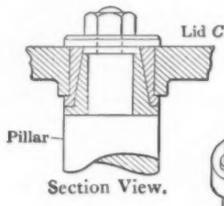


FIG. 22



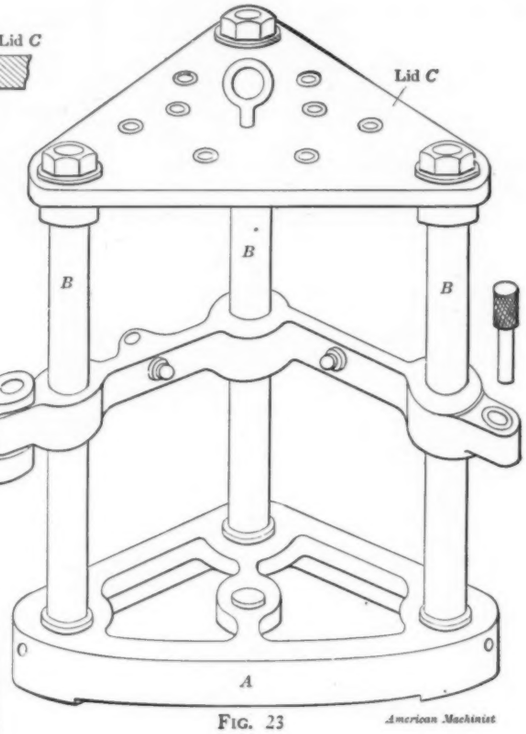


FIG. 23

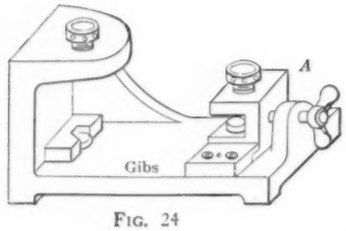


FIG. 24

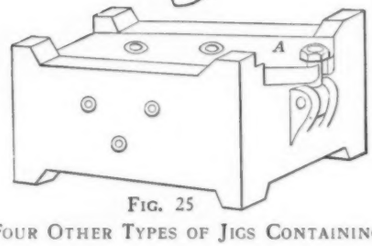


FIG. 25

FOUR OTHER TYPES OF JIGS CONTAINING SPECIAL FEATURES

Fig. 21 shows the design of an upright as well as revolving jig and its cradle. For drilling the holes *F* around the outer surface, it is placed in the cradle *E*, which has two rollers attached to it; the ends *B B* are turned a true circle to allow it to be freely turned around by hand. For drilling the holes *A*, it is taken out of the cradle and set on the end.

Fig. 22 is still another style of rotary jig and one that may be set upon the table of the drill press, as shown in the illustration. The revolving member or body *A* hangs over the side of the table. The angle *B*, which supports the body *A*, is fastened to the drill-press table in the usual manner. This style of jig is generally made up for large pieces in which small holes are to be drilled around its outer surface. The indexing is arranged the same as shown in Fig. 19.

Fig. 23, called a pillar jig, is an excellent way of making a jig for very large work. The pillars *B B B* are made of steel, driven in the base *A* and pinned. The ends of these pillars have a hardened collar which is slightly tapered, and *C* shows a corresponding bushing, as shown in the section view. With this arrangement the plate can be readily placed on or removed from the pillars. The weight of a large jig of this description can be reduced to a minimum and is approximately one-third lighter than an all-casting jig.

Fig. 25 shows a box type of jig. The lid *A* is of the swinging style, lids of different kinds being used in this connection. This style of jig is generally made when the part has a number of holes to be drilled on all sides.

Fig. 24, which is called a double-acting jig, demonstrates the use of the screw bushings and a stationary and movable V. This style of jig is made for drilling holes such as in levers, which generally have a limit of plus or minus 1/16 of an inch. The part is centered by two Vs; one is stationary and *A* carries the movable one as well as the screw bushing. When the work is centered it is held down by the screw bushings.

Notes on Pioneer Patternmaking

By Charles E. Naylor

With the invention of the steam engine came patternmaking.

Its rise and growth in America and conditions in an old-time shop.

Just when patternmaking developed into a specialized industry would be hard to determine. It had no definite beginning as did some of the other trades of the country, although we might say that, like the mushroom which grows in a night, it had a definite introduction as a full grown industry. It grew up quietly in the carpentry and joinery shops scattered principally throughout England and America.

There was no necessity for patterns except in the vicinity of the few pioneer iron foundries scattered throughout the country and these were easily supplied by carpenters and joiners. Presumably cannons and cannon balls were the first articles cast and these were simple in construction and easily made. It is hardly possible these were cored at that time and the fine engraving to be seen on the old cannon was chiseled in the metal. Other weapons of warfare and articles for every other purpose were forged until about the middle of the Seventeenth century. It was about this time that iron pots and articles for fireplaces were casted, thus requiring more patterns.

The United States was far behind Europe in all mechanical lines, therefore in patternmaking, until well into the Nineteenth century. This was due before the Revolution to the unsettled state of the country, the small number of settlers here, all of whom were scattered thinly along the Atlantic coast with very little communication between them, and that of a dangerous kind.

As an example of the latter: About 1610 "iron oare" was manufactured by the Jamestown colony and found to yield an excellent quality of metal. These colonists were, however, too busily engaged in the profitable raising of tobacco to turn their attention to this pursuit. About 1620 the London Company sent to Virginia "out of Sussex about 40, all famed to iron workers," who established a forge or more properly what is now called a bloomery. This forge was destroyed on May 22, 1622, by the Indians, and all of the company massacred together with 347 other settlers. This stamped out the iron industry in Virginia for almost 100 years, the next forge being established in 1712.

Both before and immediately following the Revolution, the lack of capital and skilled labor was another serious drawback to manufacturing in this country, so that all cutlery, tools, machinery, etc., were imported from England, made from the iron we exported to them.

Patterns were so little needed in those days as not to receive notice from historians, and it is to the private papers of early inventors that we must turn for any facts on this subject. Even these are meager.

The Steam Engine Gave Us Patternmaking

It might be said, and truthfully, too, that the birth of patternmaking took place at the same time as the steam engine. With the latter began a new era in mechanics. Denis Papin, Newcomen and Cawley were before Watt in this, but their engines were crude and unsuccessful and with the exception of the cylinder and piston, were constructed of wood. The steam engine led to the railroad, steamboat and machinery for every industry, and as the engine grew, so did patternmaking, until today it requires as much skill and thought in its own lines as any other branch of mechanics.

Extracts from Letters of James Watt

James Watt, in his letters and patent papers, makes frequent mention of various cast-iron parts of his engine.

One, in which he writes to his partner, Doctor Roebuck, under date of May 1, 1769, says, "The pattern of the regulator is at the founder's."

Doctor Small, Watt's other partner, in a letter from Birmingham, dated January 23, 1770, says, "A carpenter is making a pattern for the caster of the 15-inch wheel." It is interesting to know that by "caster" is meant the foundryman.

Another to Mr. Watt by the same writer, under date of February 28, 1770, says, "I have nothing to say about the engine, excepting that the pattern will go to Colebrook-dell tomorrow."

Another letter which does not bear directly on this article but is, nevertheless, interesting, as tending to show the crude results in casting in those days, as as follows:

Mr. Watt to Doctor Roebuck.
November 10, 1765.

Mr. Watt states that he sends detailed drawings and descriptions for a covered cylinder and piston to be cast at the Carron works; the whole inside to be 7 feet long by 24 inches diameter, "to be made as truly round and equally wide as possible." This letter was afterward indorsed in his own hand, "drawing of iron large cylinder. This cylinder was never used but came to Soho, where it lay long. It was very ill bored and thereby useless, though the best Carron could make."

Early Patternmaking in Philadelphia

In 1786 Samuel Briggs, of Philadelphia, the inventor of a machine for making nails, screws and gimlets, made the patterns for the castings of Fitch's steamboat.

During the Revolution the Eagle works was opened in Philadelphia. It had a foundry, four iron furnaces and a blacksmith and carpenter shop. It is needless

to say the carpenter shop filled all the pattern requirements.

In Philadelphia, in 1818, William Somerville opened the City Iron Works in which a number of machines were made, requiring "skilled carpenters to make the patterns."

It must not be supposed from the three preceding paragraphs that Philadelphia was far advanced over the other large cities in this line. These are merely quoted to show the general advancement throughout the country, the other cities making about the same progress as Philadelphia.

Growth of the Trade

And now just a few census reports to show the rapid increase in the trade:

Year.	Number of Pattern and Model Makers Employed.		Percentage of Increase Over Report Preceding.
	Male.	Female.	
1850 ...	1,467		
1860 ...	2,729		86%
1870 ...	3,970		45%
1880 ...	5,822		47%
1890 ...	10,140	141	77%
1900 ...	14,879	204	47%

Reminiscences of An Old Shop

In interviewing a patternmaker on this subject—a man who has spent half a century at this trade and who is still able to do as much work of as good a quality as any man I have met—he cited so many interesting facts and incidents connected with his life that I take the liberty of giving a few of them as they were told to me.

"I well remember in 1856 when my father took me to the shop of John P. Tull on Penn, below Shackamaxon street, in Philadelphia. I recall the impression that large legal indenture sheet made on me when it was produced, read and signed. It had too much legality connected with it for me to understand very much of its import beyond the fact that the said John P. Tull agreed to teach me the art of patternmaking for four years; that my board and lodging were to be furnished by the employer; that my wages were to be advanced 50c. per year for each of the four years; that I was to receive $30 per year for clothing; that, should I run away an advertisement was to be freely displayed by press or otherwise forbidding anyone to harbor or employ me under penalty of the law; and further—and most important—that my employer had the privilege to chastize me, should I become unruly, with a rope not larger than his middle finger.

"It is needless to say I took particular notice of that finger. It was immense. I never had the opportunity to compare, side by side, his finger with the rope he afterward had occasion to use, but judging from the sting, it—the rope—was not under the legal size.

"However, he was a just man, a good boss and a fine mechanic. I know a number of men now holding responsible positions who learned under him and who stand today as monuments to his ability. This pioneer patternmaker, this man who ranked among the best at the time when his calling required the hardest of brain and muscular labor, and the utmost patience, has long since pased away and his shop no longer exists. His name is not mentioned in history and as we, the last of his men, pass out his memory will probably cease to exist, but his deeds—and after all it is the deeds that count the most—will always remain as a mighty part of that whole comprising the infancy of patternmaking.

"Tull's shop would, if viewed by a later-day patternmaker, appear the oddest shop imaginable. It was considered the best equipped shop in the country at that time. It can best be appreciated by a description. It had a large Daniel's planer (not by any means as good as those in vogue 15 or 20 years ago, but crude in every respect), two large face lathes, one shear lathe, one smaller lathe and a frame circular saw. A jig saw was installed at one time, but shook the floor so much that it had to be removed. The whole was operated by an old-style beam engine, which we dubbed the 'grasshopper.' It used to be a favorite trick of the apprentices to slip over to the engine, turn on more steam and start those beams pounding up and down like the arms of a scarecrow in a gale of wind.

"My mischievous disposition was soon the means of having my indentures canceled and from Tull's shop I went to a shipyard at Chester. This shipyard, during the Civil war, built monitors, double-end gunboats, etc. The pattern shop here was equipped with nothing but two lathes, one a power lathe, which was placed in front of a blacksmith's fire, a decidedly uncomfortable place to work, and the other of foot power placed under a shed roof among a lot of oil barrels. I have often resurrected this lathe from beneath the snow in order to do my work. All except lathe work was necessarily by hand and it was no easy job to saw large planks and then plane out the twist and to size with a jack plane. Another hard job was to saw out segments with a bow saw. After a day spent in sawing these one was ready to welcome the yard bell announcing quitting time.

"Such back-breaking, muscle-tiring labor as that can hardly be appreciated by the younger generation, and they can still less appreciate the five-mile walk home after such a day's work. Those were not the days of the band saw, the jointer and the planer and neither were they blessed with trains and trolleys, but those were the days in which were made strong, healthy and resourceful mechanics—the men who laid the foundation of patternmaking."

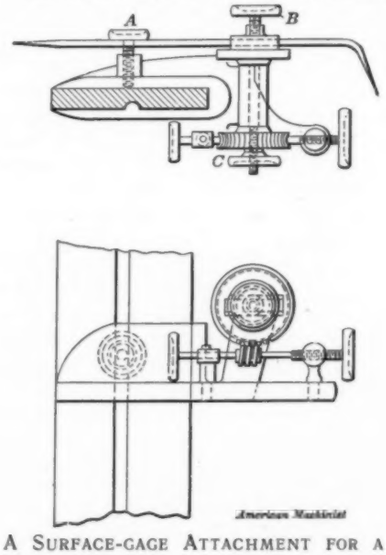
A Surface Gage Attachment for a Combination Square

By J. B. Murphy

The accompanying sketch shows an attachment intended to be used in connection with an ordinary 12-inch combination square, which has about all the good points of a standard surface gage and in addition, possesses some advantageous points that a surface gage does not.

In gaging any work or marking, where with a regular surface gage it would be necessary to set the tool upon one or more parallel blocks, the same job may be done with a square and this attachment without the parallels and without the trouble of hunting for them. Again the attachment does away with the heavy, cumbersome part of the tool, the base, and is, therefore, as easily carried as a pair of calipers.

The frame should be a brass casting,



A Surface-gage Attachment for a Combination Square

but may be made of heavy sheet brass soldered and filed. As the sketch shows, an inside rib runs in the groove of the blade and the entire gage is securely clamped at any hight, by means of the binding screw *A*. The needle binder *B*, of course, operates precisely as in any surface gage. The locking nut *C* is to bring the small worm gear tight against a shoulder on the needle-carrying spindle, and so permit of fine adjustments through the worm, though, of course, when the locking nut is loosened, the worm gear runs free on the needle spindle, and permits the needle to be moved up or down.

All the screws used are standard and may be bought from any electrical-supply house.

The worm in the writer's gage is only an old spur gear from a clock, worked over, and is carried by a bearing at the forward end and a small, center-pointed adjusting screw at the other, which prevents play.

The Cincinnati High School Shops

Editorial Correspondence

Departments opened in the new Woodward High School for the instruction of manual-training and industrial classes in machine-shop practice, wood-working, pattern-making, forging and foundry operations.

The equipment includes the latest types of machine tools, wood-working machinery, etc., with everything well arranged, well lighted and motor driven.

Details of machine installation, arrangement of classes and general features of the industrial courses.

Readers of the AMERICAN MACHINIST, are, for the most part, well informed in regard to the industrial education plan that is being carried out in the city of Cincinnati. The most recent development in connection with this educational movement, and one that cannot fail to be of interest, is the opening of the new Hughes and Woodward high schools with their unusually well equipped departments for manual training and industrial courses.

A few views in the Woodward high school at Thirteenth and Sycamore streets, are presented herewith, showing such departments as are most intimately allied with the field of this journal, namely the machine shop, pattern shop and wood-turning department and forge shop. Unfortunately, when these photographs were secured, the foundry installation was not sufficiently advanced to justify the incorporation in this article of views in that department.

THE MACHINE SHOP

Views in the machine shop are shown in Figs. 1, 2 and 3 and the character of the equipment and the general arrangement are brought out clearly. It is a safe prediction that few visitors with a mechanical training will enter the room without experiencing an ardent temptation to remove their coats and start to work in this ideal machine shop.

The tools are operated by individual motors; are so disposed as to be well lighted; and, though compactly grouped, the machines have in each instance ample floor space for student and instructor. The entire mechanical equipment in the department is painted a soft white, and not only is the effect pleasing to the eye, but the whiteness of the surface is sure to engender a spirit of neatness upon the part of the student, for each drop of discolored lubricant and unnecessary dirt of any character will exhibit itself so distinctly as to render almost obligatory the systematic application of chip brush and cleaning waste.

The tools are all of recent design. In most cases the lathes are operated by motors mounted directly on the heads, and nearly all of the lathes are provided with quick-change gear boxes, taper attachments, etc. There are nine different makes in the group of lathes and the students thus have an opportunity to become familiar with the design and operation of a variety of these tools.

MACHINE-SHOP EQUIPMENT

The complete list of machinery—most of which is plainly shown in the halftone engravings, is as follows:

American 14-inch lathe; Bradford 16-inch lathe; Champion 14-inch lathe;

FIG. 1. MACHINE SHOP IN NEW WOODWARD HIGH SCHOOL, CINCINNATI, OHIO

Greaves, Klusman & Co., 14-inch lathe; LeBlond 14-inch and 20-inch lathes (one each); Lodge & Shipley 18-inch "Patent Head" lathe; Morris 14-inch lathe, (Schellenbach type); Schumacher & Boye 18-inch lathe; Von Wyck 14-inch lathe; Cincinnati 24-inch planer; Gray 24-inch planer; Cincinnati No. 2 "High Power" universal milling machine; Smith & Mills 18-inch shaper; Cincinnati-Bickford 20-inch upright drill; Kern 20-inch upright drill; LeBlond universal cutter and reamer grinder; Victor power hack saw. Additional equipment not in place when the views were taken includes a Willard engine lathe, a Chicago Flexible Shaft Company's annealing and tool heating furnace, and a wet tool grinder.

The motors are of various makes including, Triumph; Swing; General Electric; Allis-Chalmers.

The machine shop is fitted up with benches of ample capacity, equipped with the customary vises and tool drawers. The tool room at the end is well supplied with the necessary shop tools and machinist's small tools, such as calipers, scales, center punches, etc.

At one end of the machine room, seating capacity is provided for some thirty students, and here the different classes are assembled at the designated periods for instruction in shop mathematics, shop sketching, and similar branches that can be taught by means of the blackboard. For this purpose, two large boards are mounted on the wall as shown in the illustrations.

Pattern Shop and Wood-turning Department

The view, Fig. 4, shows the wood-turning room with a class at work at the lathes. In this department there are 25 Greaves Klusman & Co. 11-inch wood-turning lathes with 4-foot bed and a Wells demonstration lathe. The twenty-five lathes are arranged in two groups driven by two motors. The demonstration lathe has an independant motor drive.

The pattern shop is equipped with eleven wood-turning lathes, one 24-inch pattern lathe, a 24-inch pony planer, and a 36-inch band saw, all made by Greaves, Klusman & Co.; a Fay & Egan double-arbor saw bench, and a bench jointer by the same concern; an Oliver hand trimmer; 12-foot glue and stain bench with electric glue pot; and an outfit of twenty-six 5½-foot work benches, each equipped with tool cabinet and ample drawer capacity.

In this department seating capacity for about 30 pupils is provided, and as in the cases of the machine shop and forge room, the blackboard is made extensive use of in handling shop problems for the practical instruction of the classes.

The Forge Shop

The illustration in Fig. 5, gives a good idea of the equipment of the forge department. Here are thirty Sturtevant down-draft forges with the requisite outfits of tongs, hammers, anvils, blueprint frames, etc. Below the floor level, at one end of the room, is installed the exhaust fan and at the other end the pressure blower for the forges. A trip hammer and power punch and shear are located at the upper end of the room and to the right will be noticed the seats for the students and the blackboards which are utilized in connection with class work.

Ample wash room and toilet facilities

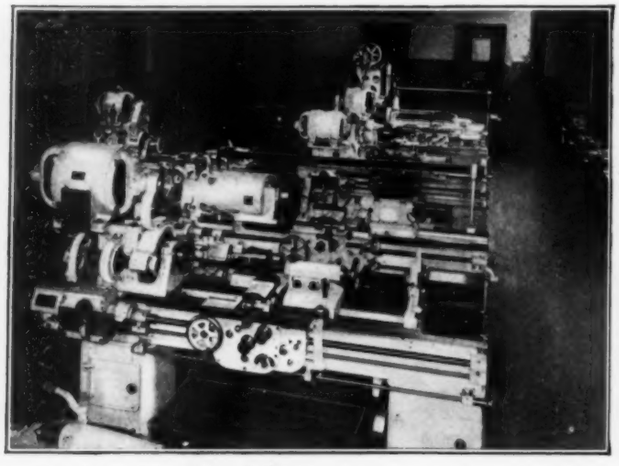


Fig. 2

Fig. 3

Other Views in the Machine Shop

Fig. 4. Wood-turning Department

and locker accommodations are provided for the boys in the industrial departments, and each room has a private office for the instructors; storage for tools, etc.

Boys' Industrial Courses

The four-year industrial course is arranged as in the following schedule; the figures giving hours per week.

First Year—English, 4; Arithmetic and Algebra, 4; Industrial Geography, 4; Drawing, 4; Turning, Pattern and Cabinet Making, 16; Physical Training (Optional), 2.

Second Year—English, 4; Applied Mathematics, 4; Physics, 4; Drawing, 4; Foundry, Forge and Machine, 16; Physical Training (Optional), 2.

Third Year—Chemistry, 10; English, 2; Drawing, 10; Applied Mathematics, Shop Problems and Practice, 10; Cöoperative plan; alternate weeks in shop and school.

Fourth Year—History (industrial of U. S.) and Civics, 5; Shop Science and Shop Practice, 10; Drawing, 10; Applied Mathematics and Shop Problems, 10; Cöoperative Plan: Alternate weeks in shop and school.

From this curriculum it will be seen that the boys in their first year take up drawing and turning, pattern and cabinet work; while their second year will take them into foundry, forge and machine work. The third and fourth years they will study under the cöoperative plan with alternate weeks in regular machine shops, and in the school.

Machine Shop Classes

Considering for the moment the second-year program, which includes instruction in foundry, forge and machine work, it may be stated of the 16 weekly periods to be devoted to these three branches, eight of 1½ hours each, are to be given up to machine-shop instruction, so that in the course of the year a total of about eight weeks time will be put in in this department. While this refers specifically to the industrial course, it should be stated that pupils taking the manual-training course also receive instruction in these branches, and, in fact, the two classes now taking their second year work in machine shop and forge shop, are in the manual-training course, which gives the student just half the time in the school shop that is scheduled in the regular industrial course. The latter course is just being inaugurated at the school and the students selecting that course and now receiving instruction in wood working and pattern making, will next year take up foundry, forge and machine work.

The two classes referred to, total 27 pupils who in addition to the actual shop practice received during four days of the week, are instructed in drawing on the fifth day.

Night Classes

There are also two night classes under instruction at this school. These are constituted of boys and men who are anxious to avail themselves of the facilities that the school presents for those desiring instruction and practice in wood and metal work. There are several machine-shop apprentices and journeymen in the evening classes who take this method of securing instruction in shop mathematics and drawing and at the same time find an opportunity to take up a different class of work than they are regularly employed upon through the day.

These evening classes have each two nights a week in the school machine shop, and one night at drawing and one devoted to mathematics. The classes average 28 students with an average attendance of 21 or 22.

The Co-operative Feature

Referring again briefly, to the regular cöoperative industrial course outlined in this article; the boys during the second year, that is in June, will decide what trades they wish to learn and what shops they desire to enter as apprentices, and the instructors will then help them to locate as apprentices in these regular commercial establishments. The following September arrangements will be made to allow them to put in alternate weeks in shop and school, for the last two years of their course, so that they will earn half-time pay for their shop work and learn their trades in commercial shops.

Under this plan a boy in the first two years should be able to decide intelligently as to which trade he prefers to learn and he will begin his apprenticeship at the age of sixteen, under suitable circumstances. If he should desire to change

Fig. 5. A Class in Forging

to another course after the first two years he will be permitted to do so.

These industrial and manual-training courses, are, of course carried on under the general jurisdiction of the Cincinnati Board of Education, with Doctor Dyer at its head, and are under the immediate supervision of the superintendent of manual training, Frank H. Ball, with a corps of instructors, one for each department.

Two Machine Shop Helps

The following illustrations are taken from the shop of the Bath Grinder Company, Fitchburg, Mass., and show two of the interesting kinks which might readily find a place in other shops.

FIG. 1. A HELP IN SCRAPING WORK

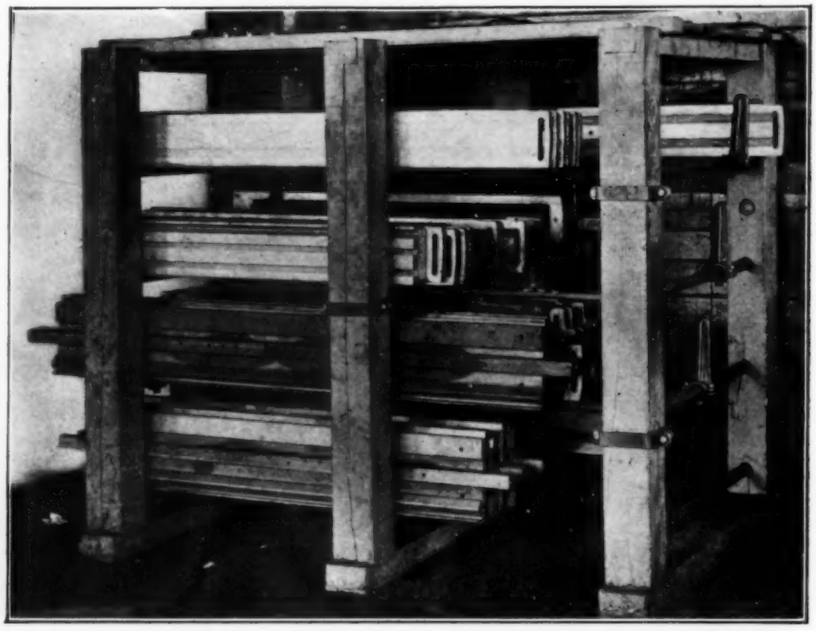


FIG. 2. A RACK FOR SEASONING SLIDES AND TABLES

Fig. 1 shows a convenient device to be used in scraping in saddles, or other moving parts which have to be scraped to a perfect bearing. This consists of a large flange having three supporting legs made of steam piping and having angular flanges on the end for fastening to the floor. This makes a very rigid support.

Fastened to one of the legs is a support or fulcrum for the lever in which the slide is moved back and forth on its bearing, the body being bolted to the top of the supporting frame as shown. The clamp shown on the end of the connecting rod is simply clamped over the front ways so that the strain of moving back and forth comes at a central point. With this device it is an easy matter for one man to move the saddle back and forth to show where it bears on the ways of the base, and saves the necessity of calling one or two helpers from other parts of the shop.

Fig. 2 shows a rack for storing finished or semi-finished parts of machines; in this case grinding-machine tables. This is used principally for seasoning the grinding tables shown, these being rough planed and set on edge, as can be seen. Cross rods are put in at convenient points and the arms clamped on the end rod show how the work is held in position so as not to be jarred over and damaged, and also for convenience in separating work of different sizes. These can be moved along as desired, and almost any kind of straight work stored on racks of this kind so as to be out of the way and at the same time easily accessible. The men shown around the post have nothing to do with the supporting cross rod, but are merely to offset the seasoning cracks which appeared in the timbers after they were in place.

Locating a Cast Iron Bushing in Place

BY R. A. RUDOLPH

Everyone knows the superiority of a bearing bushed with cast iron or bronze to one bushed with babbitt. In a place where a three-point bearing is desirable, such as an outboard support for the cone pulley of a shaper, the general practice is to bolt the arm into position and pour babbitt around the shaft, thus causing natural alinement of the bearings.

Such an assembly leaves much to be desired, however. The difficulty in bushing the arm with cast iron or bronze before bolting into position is in the proper alining of the bearings due to the extreme difficulty in boring the arm at right angles to the bolting surface.

This difficulty is entirely overcome by one company, however, by their fitting a cast-iron bush over the shaft and after bolting the arm into position, pouring babbitt between the bushing and the cored hole in the arm.

This construction incorporates all the good features of a solid bushed bearing with the added advantage of costing much less as a manufacturing proposition.

Where Shall the Boy Start?

In the good old days, after the boy had swept the floor, snagged castings and performed other similar work that had no connection whatever with the machinist trade, he was generally allowed to spend a few months on a bolt cutter or a dilapidated drill press. Then the lathe and other machines became his prey until he was graduated into the "setting-up" class. Here for the first time, he began to see what all his drilling, turning and planing meant. He had hardly realize why the pieces had to be so accurate until he tried to fit them together. Then he could see just where fit and finish were important and where they were not.

That is why some of those who have studied the question of apprenticeship most closely are beginning to believe that it is better in many cases to start the boy in the erecting department. Here he can become familiar with the product of the shop as a whole, can see how it goes together, can see the reason for many things that he otherwise takes on faith or inwardly considers as very foolish, and the parts mean more to him when he comes to work on them.

Machine Shop Lighting

By C. E. Clewell *

There are three methods of machine-shop lighting: By general overhead illumination; by specific illumination with individual lamps; by a combination of the two. With the older lighting units the last two methods were used. With the newer units the first method may be employed, giving more efficient and agreeable results than were before possible.

*Lighting expert, Westinghouse Electric and Manufacturing Company, Pittsburg, Penn.

With the introduction during the past 10 years of the Nernst, Cooper Hewitt, and tungsten lamps, with candle powers lying between those of the arc and carbon filament lamp, new possibilities have been presented in the lighting of machine shops. An overhead system of illumination may now be used with the elimination in large measure of individual lamps, thus broadening the possibilities of machine-shop lighting by the use of units of sizes adapted to certain cases which it has been impossible hitherto satisfactorily to meet by either the arc or carbon filament lamp.

This paper presents briefly the general requirements for machine-shop lighting together with certain items regarding the available light units—new and old—adapted for such illumination.

Practical Requirements

Two of the most important requirements for machine-shop lighting are sufficiency and continuity of the light. From the economic viewpoint no factory can afford to have its employees working under an insufficiency of light, since the losses in production far overbalance any apparent economy in the saving of energy by such practice. Furthermore to be of the most service, machine-shop lighting should possess the feature of continuity, since the demoralizing effect of unsteady or intermittent service is great.

To these two general requirements several others may be added as follows:

1. Good and sufficient light should be provided for each employee.

2. Good light should be furnished everywhere on the working plane, and where possible, especially where the floor space is crowded, this should be satisfactory without regard to the location of the workmen, which implies uniform illumination.

3. Where possible the light should be such that individual carbon lamps will be unnecessary, although careful judgment must be exercised in this particular. In some cases the use of carbon filament lamps is a necessary feature of expense.

4. The illumination should be provided by an arrangement and size of units which will avoid glare due to the light from an intense lamp striking the eye.

5. A type of lamp should be used adaptable to the above requirements as well as to the class of work performed and the limitations as to mounting hight and general physical conditions, such as clearance between cranes and ceiling, and the like.

FIG. 1

Overhead lighting for low ceilings with tungsten lamps. Note the small size of the units to prevent glare.

General Classification

Machine-shop lighting may be classified in three divisions as follows:

a. General overhead illumination.

b. Specific illumination by the use of individual lamps close to the work.

c. A combination of the two.

In many cases the requirements of machine-shop lighting as outlined above may be secured by the use of the first of these methods, the so called overhead illumination. In this scheme the lamps are placed high enough to be out of the range of vision and of such size and so spaced as to furnish illumination practically independent of the position of the work. This method, eliminating in large measure the necessity of the individual carbon-filament lamp, possesses a number of very desirable features and has proved itself for many cases the most successful of the three methods indicated above.

Until recently the second and third schemes of machine-shop lighting were the only ones possible for the following reason.

In former years the arc lamp on the one hand and the low candlepower carbon-filament lamp on the other were the only available units for factory use. In those cases, therefore, where the permissible mounting hight in the shop was too low for the use of arc lamps and at the same time too high for the use of the small carbon-filament lamp as a gen-

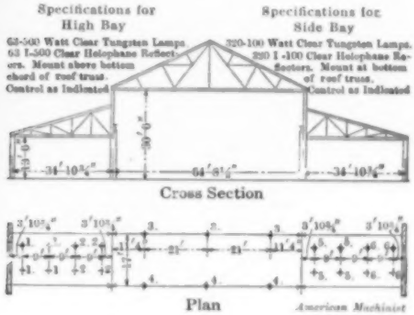


FIG. 2. TYPICAL LIGHTING LAYOUT FOR MACHINE-SHOP INSTALLATION WORK

eral overhead unit, the only alternative was to place the carbon-filament lamps close to the work, thus using them as individual drop lamps over each machine. In short there was not then available a lamp possessing candlepowers intermediate between those of the arc and carbon-filament lamp, which could be used in such cases as here described.

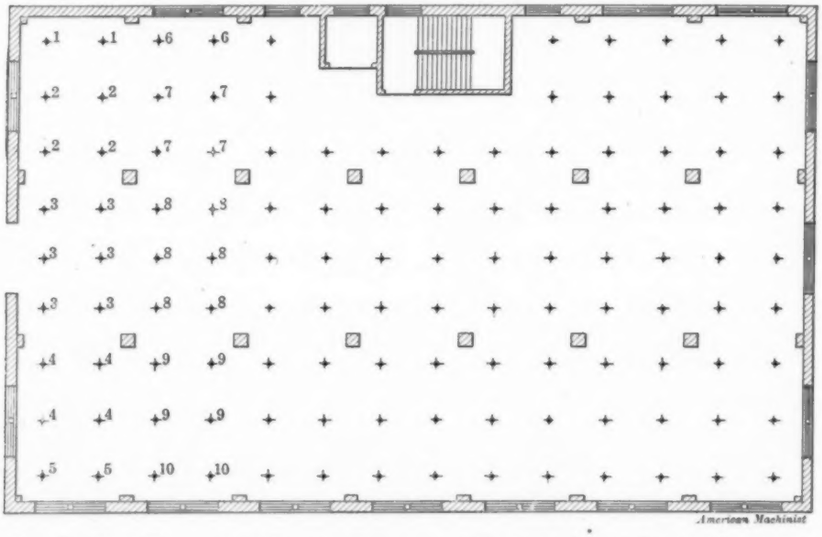


FIG. 3. GOOD PRACTICE IN SWITCH CONTROL OF SYSTEMS USING LARGE NUMBERS OF MEDIUM-SIZED UNITS

The new lamps now available with candlepowers lying between those of the arc and carbon-filament lamp, have made possible an overhead system of illumination with the elimination to a considerable extent of individual lamps, units now being furnished adapted to cases which it has been impossible hitherto satisfactorily to meet by either the arc or carbon-filament lamp.

THE OVERHEAD SYSTEM OF LIGHTING

The advantages of the overhead method of illumination as compared to that system in which individual carbon-filament lamps are mainly depended upon is as follows:

First of all the eye is subject to a harmful effect from the use of a single lamp placed directly over and close to the work. The bright spot of light directly over and close to the work, if surrounded by a region of comparative darkness, causes the eye to become fatigued since the line of vision is continually changing from the bright area to the darker surroundings. This strain on the eye can largely be avoided if the working surface is provided with a uniform light of moderate intensity.

A second advantage is the economy in the maintenance of such a system as well as its neater appearance.

With these various light units, therefore, ranging from very low to very high values of candlepower, it is now possible in practically every case of machine-shop lighting to choose a unit adapted to a general overhead system which if properly installed will meet the requirements above outlined.

CHOICE OF THE NUMBER OF UNITS FOR A GIVEN FLOOR SPACE

The selection of units most suitable for given conditions in a machine shop, together with the proper installation of the system, involves considerations worthy of careful study. The solution of the problem lies in the choice of the number and size of units, together with an arrangement of the installation which will adhere to the above requirements. The question of economy in operation will be carefully studied as well as the relative first cost values of the various available light units, and their installation.

Under the details of lighting installation work no question is perhaps of more importance than the choice of the number of light units for a given floor space to be lighted. This question is of the utmost importance in the realization of a uniform and satisfactory distribution of the light and should, of course, be settled when the design is first undertaken. In laying out the lighting system, then, the number of units required to furnish a uniform light and make it possible to work with equal ease at any point on the floor without regard to where the work is placed, should first be settled and then the selection made of a size and type of unit which will furnish a light of sufficient intensity.

In this connection reference may be made to a case in which a large area was to be lighted with tungsten lamps. The use of 250-watt tungsten lamps in such numbers as to give uniform and sufficient light seemed favorable. By the use of such a large unit the number of lamps per bay would have been small, resulting in a low first cost for the installation of the lamps. The number of the workmen to work under these lights was such, however, that with the use of 250-watt units so spaced as to give uniformity of

FIG. 4

A room with a low ceiling where tungsten lamps replaced unsatisfactory arc-lamp lighting. The arc lamps had not been removed when photograph was taken.

FIG. 5

A shop where 250-watt tungsten lamps were used successfully to furnish general lighting from overhead. Note the uniformity of the light on the working surfaces.

illumination together with a sufficient intensity of light, workmen located at certain points under the system would be in such a position relative to the overhead lights as to cast rather marked shadows on the work, making individual carbon-filament lamps a probable necessity.

In this particular location carbon-filament lamps had been in use for years and required continual adjustment to take care of constantly changing conditions of the work. This expense, properly classed as maintenance, was considered sufficiently large to warrant the removal of all the drop lamps and, to make this possible, the installation of an overhead system of lighting.

The use of 100-watt tungsten lamps, nine per standard bay rather than four 250-watt lamps for the same area, produced a satisfactory result. Here it should be noticed that the choice of the number of units per bay depended on the matter of furnishing light equally good *in direction* at any point in the bay. The use of 250-watt lamps would have resulted in a distribution as uniform and an intensity equally as great, without, however, fulfilling the main requirement and in this case the one most important.

FIG. 6

Good distribution of light with low ceilings and medium-sized Cooper-Hewitt lamps.

FIG. 7

Uniformity of light where medium-sized Cooper-Hewitt lamps are mounted well up out of the range of vision.

THE MOUNTING HIGHT OF LAMPS ABOVE FLOOR

The mounting hight of lamps in machine shops will often be limited by the details of building construction and the interference of cranes. In general all units should be mounted if possible at such a hight as to be out of the range of vision so as to prevent glare. This condition is subject to a variety of interpretations. For example the effect of a small lamp in the line of vision will not be as harmful as that of a large one. One solution, therefore, of this condition when lamps must necessarily be mounted low with respect to the floor, is to use lamps of a low candlepower and many of them. This leads to the question of glare and eye strain in those cases where the lamps are of such an intensity and so nearly in the line of vision as to be harmful. This feature of glare is probably of less importance in factory work than in offices, but is none the less harmful so far as net results on the eye are concerned.

From the standpoint of economy the glare due to rays of excessive brightness striking the eye from a lamp mounted too low, should be avoided as it results in a lowering of the sensitiveness of the eye, and the intensity of the light on the work, while possibly ample otherwise, may be insufficient due to this lack of sensitiveness. Physically speaking the effect of this glare and the subsequent eye strain is an evil for the employee and employer as well. It is evident that a man to be of the most value as a workman should be surrounded by the most advantageous conditions for promoting ease in performing his work.

Another feature of the mounting hight is in the matter of furnishing light at such an angle that the side of a vise or a machine part may be adequately lighted. For example the point at which the tool is making a cut may require light from any angle much more than from a point vertically overhead. For a given spacing of light units the higher the lamps are mounted the more concentrating must be the reflector to produce the highest efficiency of vertical illumination on the working surface. As indicated above, however, this vertical light is often not nearly so important as the side lighting on machine tools or machine assembly.

One way to secure more side light is to lower the lamps and to equip same with broadly distributing reflectors so as to distribute the light sidewise as well as vertically downward. On the other hand if the lamps are mounted too low they become objectionable by being in the line of vision when a workman looks up from his work, thus producing a glare and consequent annoyance. In such a case it will be found advisable to mount the lamps high, out of the range of vision, using at the same time a higher candlepower lamp and a more broadly distributing reflector than would be required for producing uniformity of the vertical light. In short the general practice of mounting the lamps well up out of the range of vision will be found to be not only more pleasing in its effect on the appearance of the shop but in the long run more efficient.

THE LIGHTING CIRCUITS

The question of the lighting circuits is of importance in that certain units are adapted only to direct current, others work most favorably with certain frequencies of alternating current, and all units to be of the most effective value should be supplied with a voltage practically constant in value. The problem of the circuits is, therefore, one that should be studied with much care. In general, throughout machine-shop practice, the power load for electric motors will exceed that for lighting. This makes it desirable to have a lighting circuit entirely separate from the power circuit. By this means the voltage on the lamps may be kept practically uniform, and far easier than if the load is varying over wide ranges due to motors at times running light and at others probably overloaded. This feature will be found to offset many times the greater cost of a separate lighting circuit.

THE WORKING DRAWING

In the installation of various lighting systems throughout machine shops it is

desirable to provide the wiremen with a working drawing containing such information as to enable the installation to be made in conformity with the plans of the engineer in charge of the work. Such drawings to be intelligible to the average wireman should be as simple as possible. In general all that is required for such a drawing is the outline of the floor space to be lighted together with the designation of the light units in some clear and distinctive form located to scale and as shown in Fig. 2. This drawing should contain the dimensions of the floor space together with the distances between lamps and the distances between edge lamps and walls or boundary lines.

The specifications on such a drawing should contain the number and type of light units, the number of reflectors and their style, the number and style of reflector holders, the mounting hight of socket above floor and the method of switch control, perhaps most easily shown on the drawing by placing the same numeral adjacent to each lamp to be controlled from same switch. It will be found advantageous to have several blueprints made from such a drawing and to furnish the maintenance and wiring departments with copies.

Switch Control

The switch control of the lamps in any lighting system is important, but this is especially the case where large numbers of medium sized units are used in a given installation. That method of switch control is most economical where the interest, depreciation and maintenance involved in the first cost of the installation of switches and wiring equals the energy saved by its use. Too great a refinement in the placing of switches may result in a first cost in excess of the saving in energy by their use. Particularly is this the case where, due to surrounding conditions, the shop location is not provided with any daylight, artificial light being required at all times. Here if the number of workmen is great practically all of the lamps will be needed all of the time, and too great a refinement of the switch control is an item of first cost not warranted.

In practice it will usually be found advisable to install a reasonably large number of switches for each installation, this cost usually being low compared to the energy saved by the ability to turn off the lights in sections when not needed.

One item of considerable importance is in the placing of switches in large installations at uniform places along the installation, that is, if located on columns, the switches should be placed on columns located on the same side of the aisle where possible, and on the same relative side of each column.

A fairly safe rule to follow in arranging the switch control, is to control the lamps in rows or groups parallel to the windows or skylights. This scheme is shown in Fig. 3. Those lamps away from the windows will be required in many cases when the work near the windows is still sufficiently illuminated by daylight. If the rows of lamps are controlled perpendicularly with respect to the windows, all the units in a row will necessarily be on at one time, when often a portion only is needed.

A reference may be made to the requirements of artificial light at night as compared to that required when mixed with daylight. In general it will be found that more artificial light is required during the day than at night. The reason for this may be briefly stated as follows: While the eye is subjected to the stimulus of ordinary daylight, it is in a state as usually to require more artificial light to give the impression of satisfactory illumination than when the eye is relaxed under the influence of the surroundings of natural darkness or the lower intensities of artificial light to which it may be subjected. So far as this item is concerned in its relation to factory lighting, it is a question whether or not the refinement of providing two intensities, one for night and one for daytime, is warranted. It would hardly appear so.

Maintenance Problems

The foremost item connected with the operation of a machine-shop lighting system is its systematic maintenance. A lighting system to furnish the best results should be maintained with the same care which attended its installation. The factors which go to make up the maintenance on various lighting systems include the renewals of incandescent lamps and the cleaning of reflectors and shades. In lamps possessing mechanism, repairs must be made from time to time, and the trimming of arc lamps is the large item to be charged to that system.

First of all if the machine shop is of sufficient size to warrant it, there should be an organized maintenance department for looking after this work. This department should possess an accurate record of every lamp in the shop and its type. Arrangements should be made for carrying in stock a sufficient supply of repair parts and renewals. It is important that a record of all such repairs as well as of the renewals be made, together with the labor involved. These records will show the maintenance costs of the various units and if studied will serve to indicate if this expense is excessive due to abnormal conditions of the circuits, in the handling of lamps, or otherwise.

The designing engineer may be of service in preventing excessive maintenance by seeing to it that the lamps are located so that renewals may be easily made.

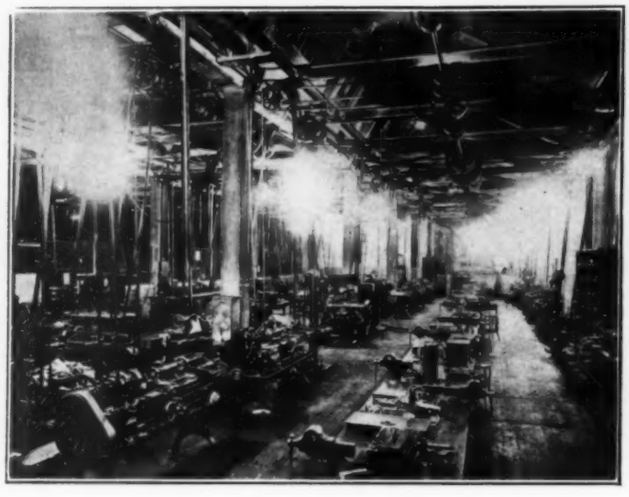


Fig. 8

Clearness of detail of machine parts is here brought out by the use of medium-sized Cooper-Hewitt lamps mounted at the girder line.

Fig. 9

Excellent distribution of light obtained by the use of large numbers of Cooper-Hewitt lamps mounted high above the floor. Note the absence of shadows.

A practical instance will indicate how the maintenance may be affected by this method of installing the lamps. In buildings of open steel construction, so-called stringer boards are often placed between girders, on which the lamps are supported. If these boards are not of sufficient strength to support a ladder, difficulty will result in getting at the lamps for renewal and cleaning purposes. The higher expense for providing such boards of sufficient size for these renewal purposes will be offset by the greater ease in making renewals, thus reducing the maintenance expense.

The cleaning of glass reflectors is an important item. The depreciation of the efficiency of such reflectors due to accumulations of dust and dirt is great. The proper time to clean a reflector is when the loss of light interpreted into a cost value, and due to dust and dirt accumulations, equals the labor and material cost in cleaning same. This rule may be applied without great difficulty as follows: If the cost to clean one glass reflector is say 3 cents and if tests on the depreciation of the reflector from week to week while in service show that the value of the light lost interpreted into energy equals 3 cents in two months time, then it follows that the reflectors should be cleaned at the interval of two months.

In order to realize the best results from such a maintenance department it is desirable that all the lighting installations be inspected once a day. An inspector in making his rounds should record all lamps burned out or lamps out of service, together with the number of lamps missing or otherwise in need of repairs. This information embodied in a report and furnished to the maintenance department in such form that all such defective lamps can be quickly located, will enable the replacing of all such lamps accurately and promptly, and will also furnish at the same time a valuable record for calculating the maintenance costs.

The Relative Cost Factors of Light

In machine-shop lighting the manager is concerned with the cash value of the light. How much of a return in quantity and quality of work will result from the adoption of a superior lighting system as opposed to an inferior one, is the determining question. The value of good light may be placed in terms of time saved by the employee in performing a given amount of work, in the greater accuracy and perfection of the work, in saving the eyes of the workman, and in promoting the facilities for better and more work by providing brighter and more cheerful surroundings. If then, as an example, better light may be interpreted in terms of so much time saved by the employee in factory operations, the equivalent wages of this time saved is an asset to the credit of the improved lighting system.

In one shop a superintendent volunteered the information that his men in the early morning and late in the afternoon lost from one to two hours per day due to insufficient light. This meant that the wages paid for this hour or two each day, was a complete loss to the company.

In one instance where a certain lighting installation was contemplated, it was found that the first cost for installing a superior system of tungsten lighting amounted to one-third of one per cent. of the wages paid to the employees for one year. This is the one three-hundredth part of the wages, or the equivalent of the wages for about two minutes per day for a year. The annual operating cost of this system would have approximated this same value. Hence the total expense of installing and operating such a system for one year could have been covered by the wages for four minutes per day. Poor lighting would have cost at least half this amount, hence the total first cost and yearly operating expense combined for good lighting over against poor light would have been reducible to the wages of two minutes per day for a year. If as in the case cited above the losses per day amounted to from one to two hours per day due to poor light, the wisdom is at once apparent of expending the equivalent of the wages for two minutes per day to save the wages of, say, one or two hours per day, or from 30 to 60 times the expenditure, by the installation of a good lighting system.

Often, therefore, an apparently expensive lighting equipment will be found to be economy in the end, due to the conditions above stated. If one kind of light has a marked advantage over another, its use will result either in better or more work, fewer delays, less eye strain, and in general satisfaction, all items chargeable to the credit of the improved light.

Fig. 10

Machine shop lighting as found.

Fig. 11

Conditions after an improved tungsten lighting system was installed.

Both photographs for these illustrations were taken in the same shop and with the same length of exposure.

The first consideration in machine-shop lighting, if looked at in its proper sense, that is as an invaluable accompaniment to the quality and quantity of the work performed in a given time, is the usefulness of the light rather than in placing too much emphasis on cost values, which are often misleading. If, then, the attitude of the shop and factory manager can gain something of this attitude to the lighting question, viewing the problem as an asset to factory production, and will study the kind and quality of light most suitable for each condition of work, better results may be expected than when all attention is fixed on slight differences in first cost or annual charges.

Dry yellow pine will weigh approximately 34 pounds less per cubic foot than rain water, while mahogany is three pounds heavier, and either lignumvitæ or ebony is 20 pounds heavier than water.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

An Automatic Tool Room

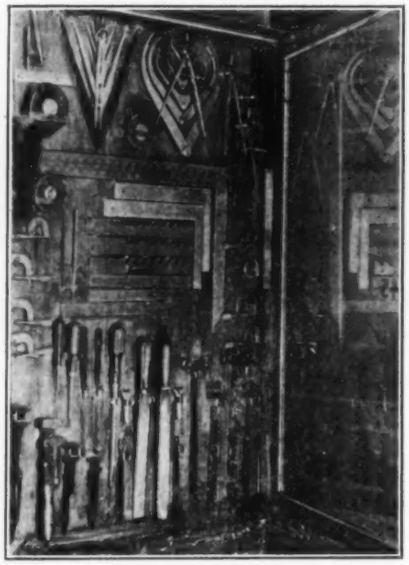
The expense of a toolroom attendant is far too great for many places where some system of caring for tools and equipment is badly needed, but a satisfactory substitute for a regular tool cage, may be found in the arrangement shown in the accompanying cut, which may be altered to meet the requirements of any particular case.

Suitable hangers or clips are provided for each tool and its outline on the backboard filled in with bright red paint so that the absence of any tool is conspicuous and as the use of tools is confined to certain hours, a glass door is provided, which is locked at all other times. Tools can be used freely, but at the end of the period their return is insisted upon and any absence readily noted. While this arrangement gives the person in charge of the work a quick and easy means of checking up the tools, its successful use for four years has depended greatly upon its influence upon the persons using the tools, which may be stated generally as follows: An act which meets with *general disapproval* is *less apt to occur* as the chances for its *becoming generally known* become *greater*. It is well recognized that publicity is all that is required to eliminate many evils, and publicity should be the guiding principle in planning an automatic toolroom. Without doubt the chances of detection for a person stealing from such a case, appear to be much greater than they really are, which, however, is a powerful influence for honesty.

The expense of maintaining an equipment of small tools may be divided into that caused by loss or disappearance, and that caused by damage, and the most effective way to prevent the latter is through toolroom inspection by an attendant every time a tool is returned after use. It will be noted, however, that most of the tools shown in the illustration are not such as to be easily damaged by ordinary use so the expense due to loss may be divided into two parts; that due to tools lost through carelessness or forgetfulness and tools wilfully stolen.

Experience has shown that the plan outlined is about as successful in caring for tools used by students as a regular toolroom having an attendant, as the loss from the toolcase shown, to which about 300 students had access, averaged between 10 and 20 dollars a year; probably intentional stealing of micrometers, a particularly attractive morsel, accounting for much of this.

While particularly adapted for student laboratory work, this system ought to work equally well for small shops in which the workmen are not decidedly at odds with the management.



AN AUTOMATIC TOOL ROOM

Often a toolroom attendant is employed as a matter of course, without considering that his wages will replace many tools lost or broken and the question really resolves itself into an estimation of the relative expense of the automatic compared with the regular toolroom and the selection of the more economical. H. L. WHITTEMORE.

Cambridge, Mass.

Can Thin Galvanized or Tinned Stock Be Welded?

Can 30-gage tin-coated, lead-coated, zinc-coated (galvanized) or plain black sheet metal be either lap welded, spot welded or butt welded electrically. I would be pleased to hear from readers experienced along these lines.

Cincinnati, Ohio. JOHN SCHMIDT.

The Suggestion Box

With reference to the article on a suggester in place of a suggestion box on page 266 by B. W. Church, I wish to say that I believe the idea is impractical and would not be successful. Some six years ago I brought up the question of placing suggestion boxes in the different departments of the shops of the General Electric Company's plant in Schenectady. It was taken up and has now been used for over five years. I know that the company has received many valuable suggestions as to improvements, safety and money-saving devices.

A committee was appointed, consisting of the general superintendent, the mechanical superintendent and a superintendent of one of the districts, of which there are five or six. They meet once a month and discuss the different papers and letters. In many cases sketches are attached to the letters, which mostly are written on printed forms for this purpose and which the workman will always find in the immediate neighborhood of the suggestion box. But, should the workman not have the ability to himself make a sketch he would most likely call upon a friend to help him out. In one case I was called upon to do this. But sketches are not essential, and should the committee find that the suggestion warranted further consideration the man would be called upon to explain further details.

I know that the suggestion boxes have been very successful in this immense plant, which at that time employed as high as 20,000 men. Some have received as high as $100 and over for one valuable suggestion. The men have confidence in the management and know that they get fair play and there is no stealing of ideas.

I do not believe the average mechanic would have enough confidence in any one man designated to take the place of the suggestion box. Machinists and mechanics who make suggestions are bright and brainy enough to explain and even rough sketch their own ideas and would resent any interference. In most cases they do this work at home so they do not lose any time, which would be unavoidable if Mr. Church's idea was to be carried out properly. FERD B. JACOBSEN.

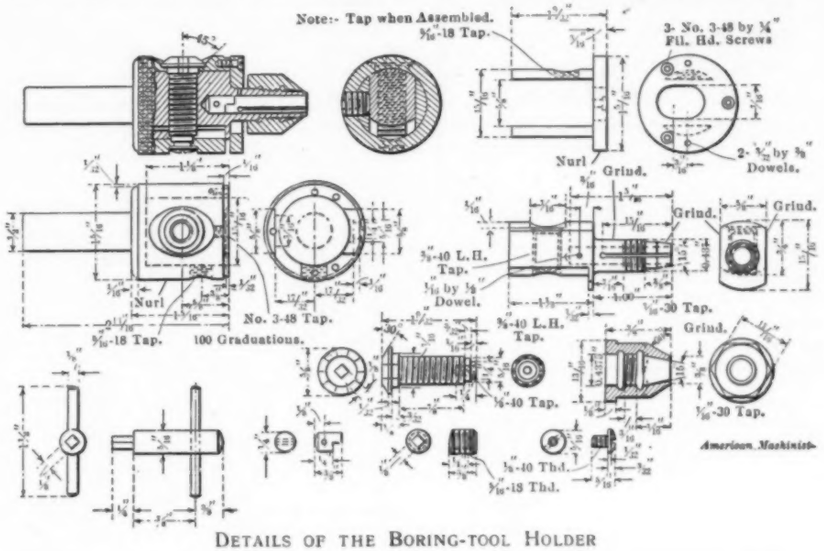
New York City, N. Y.

A Micrometer Boring Tool

The boring tool shown in the illustration is intended for toolmaker's use, and as can be seen from the drawing, allows of setting to quarter-thousandths.

I have been asked for blueprints of this tool by so many toolmakers who wished to make one, that I show it here fully detailed, as there is no doubt but what many will see its merits and wish to make one.

Philadelphia, Penn. T. A. C.



DETAILS OF THE BORING-TOOL HOLDER

Compulsory Letters of Reference

Years back it was the custom, more so than at present, for a man on leaving his employer's service, to be presented, on request, with a reference signed by the proprietor or other high official. Nowadays, as far as the writer's experience goes, this is the exception rather than the rule.

The absence of open references is a condition to be deplored, and in view of the wording of many advertisements represents to the writer's mind almost a calamity.

Although open references are so difficult to obtain many appointments are only open to applicants showing " . . . . . three references of recent date."

This is similar to subtracting something from nothing.

It is exceedingly unjust for a man who has been faithful for a number of years to be denied the means of obtaining a good situation, because he has been indiscreet in some minor matter, or as is often the case because he wishes to take a position with a rival company.

Why should it not be compulsory on the part of an employer to give a reference, consisting of answers to a series of questions to be decided or compiled according to law.

It may be argued that the compulsory giving of open references can lead to lending the same to others than those entitled. Against this it may be said that it has not been found to so work with regard to the indentures of apprenticeship. A man would usually value them too highly to entertain such an idea; or the recipient can sign his name to such a paper, when it becomes as secure as a cheque.

The series of questions mentioned above need not be long and might be somewhat as follows:

1. How long has —— —— been in your employ?
2. In what capacity employed?
3. Did he leave under compulsion?
4. Have you found him to be dishonest?

Signed { Employee / Employer

Date.....

This will doubtlessly be regarded as a very decided stand to take, but is it not just?

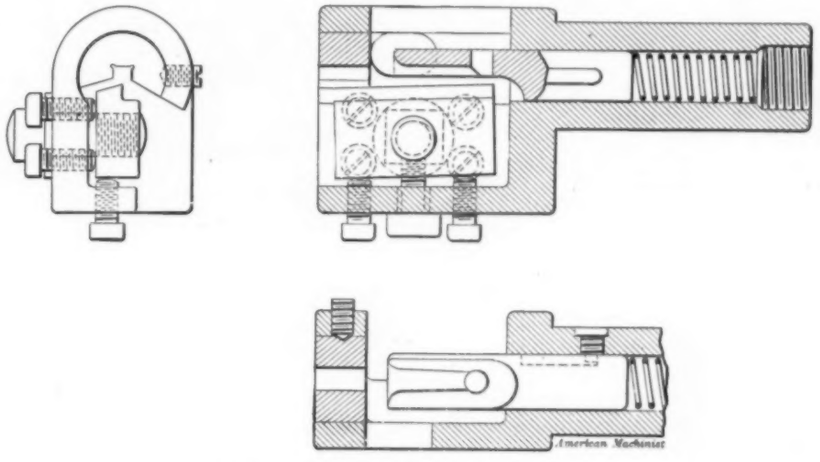
Liverpool, Eng. EMPLOYER.

A Box Tool for Small Taper Pins

In box-tooling taper pins of small diameter that have to be held to close dimensions, the tool here shown does the work better than any I have yet seen. The idea, I think, is original, but may perhaps have been used, but as it does the work in a very satisfactory manner, others may wish to apply it.

The cut shows very plainly the way it is made, and but very little is left to explain regarding it. The spring plunger has a taper hole to fit the work and is stiff enough to prevent the cutter forcing the work back when finishing the cut. Being under spring pressure, it is, of course, always in contact with the work, and the result is taper pins that are to gage.

Philadelphia, Penn. C. A. T.



A BOX TOOL FOR SMALL TAPER PINS

Adjustable Male and Female Thread Gages

There is undoubtedly a good field for any toolmaker who could design a compact set of standard male and female thread gages that a machinist could use when cutting threads on a lathe. The usual methods adopted in repair shops are both laborious and expensive, especially on large work where a man has to take a job out of the lathe several times before he has made a good fit.

It often happens that both a nut and bolt have to be made, and the chances are there is not a thing in the place that can be used as a gage, therefore the machinist makes them as near as he can to the standard.

The gage could be designed in such a way as to be adjustable, so that it could be used on work that is a little under or above standard, provided the number of threads per inch was the same.

New York City. DAVID FARNIE.

Discussion of Previous Question

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

The Inspection of Jewels

At pages 663 and 773, Volume 33, Part 2, of the AMERICAN MACHINIST, are descriptions of the manufacture of jewels as they are used for watches. The processes indeed are very interesting and their descriptions are of high educational value. While the processes are described, nothing is said of their inspection, and as the requirements of jewels in instruments for the detection of very slight currents, or the very slightest variation of current are probably more exacting than in watches, their inspection is perhaps also more rigorous. When we consider that the jewels are only about 3/32 inch in diameter and hardly thicker than 1/32 inch, some of which may be drilled through and others not, but all of them being cup-shaped, their handling while under inspection is a ticklish operation. It is still more so, as these jewels are being inspected by the aid of microscopes and to be independent of daylight, which is of varying intensity, they are inspected by artificial light.

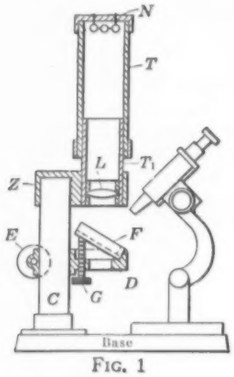


FIG. 1

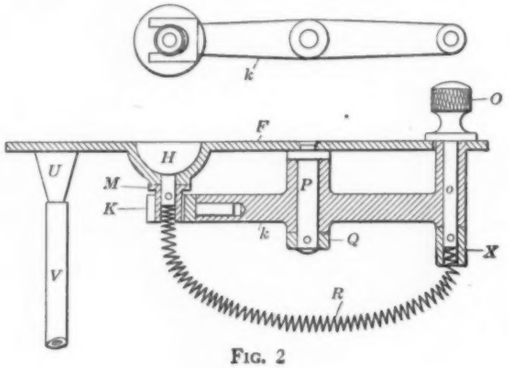


FIG. 2

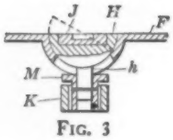


FIG. 3

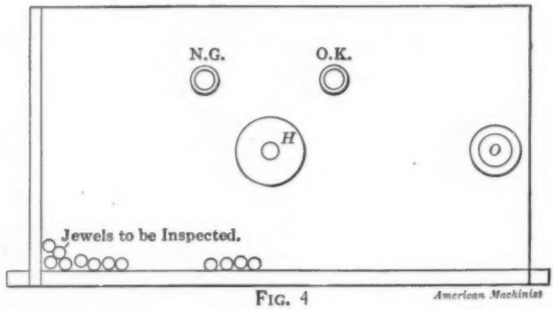


FIG. 4

APPARATUS FOR THE INSPECTION OF JEWELS

In Fig. 1 apparatus is shown, as designed by me, for this purpose; the whole apparatus is inexpensive, as there is but a small amount of machine work required, since the column *C* is a piece of brass tubing which is fastened to the base. On top of this column is the bracket *Z* holding tube T_1 at the lower end of which is the lens *L*. Over this tube T_1 is the tube *T* made to be clamped in any position (the screw for this purpose is not shown) on T_1 and carries on top the Nernst burner *N*. Below tube T_1 is the bracket *D*, which is adjustable up and down and can be clamped in any position by the nurled screw *E*. Hinged into this bracket is the table *F*, which can be tilted to any angle by the screw *G*. Placed upon the base, but not fastened, is the microscope.

Now the table *F* is really the most interesting of the whole instrument because it contains that part which enables the inspector to keep the jewels always in focus of both lens *L* and microscope, and also to quickly turn and cant the jewels into any desired position.

A clearer illustration of this device is given in Figs. 2, 3 and 4. Directly in the center line of the light the table is counterbored spherically to receive the hemisphere *H* with its depending stud *h* from which it is easy to see that this hemisphere is free to turn.

Fastened to *h* is the collar *M*, the purpose of which is to keep *H* in position and also to supply a detachable means for fastening spring *R*. Collar *M* fits into fork *K* of the lever *k* free to turn upon stud *P* and held up by collar *Q*. At the other end of lever which is made to extend through *F* is the knob *O* with the stud *o*, at the lower end of which is the collar *X*; its purpose is the same as that of *M*. The table *F* is slotted at the end where the end lever *k* passes through so that the lever may be oscillated through a small angle as indicated by the center lines in the plan view. The collars *M* and *X* are connected by spring *R*, which serves as a flexible shaft.

Fig. 3, which is a section through the semi-spherical member, shows how the hollow seat of *F* is slotted about 30 degrees on each side of the center line, which enables the hemisphere *H* to oscillate in obedience to any movement of the lever *k* through the knob *O*. The canting effect is indicated by dotted lines in Fig. 3. It is, therefore, easy to see that if we turn the knob *O* this motion of rotation is immediately imparted to *H*, also if we at the same time shift the knob *O* up or down as permitted by the opening through which lever *k* passes, the hemisphere *H* will cant proportionately so that the operator has perfect control of his instrument without the least inconvenience. In Fig. 3 is shown how the member *H* is recessed to receive a disk *J* of another material, which is provided with a small pocket in which the jewels are deposited. This piece *J* is made of non-reflecting material.

In Fig. 4 a plan view of table *F* is given, showing the positions of *H* and the knob *O*. At the left-hand end and at the bottom are strips to hold the jewels upon the table. Above *H* are two holes continuing in small funnels *U*, Fig. 2, into which are slipped short pieces of rubber hose *V* leading into small pasteboard boxes, which receive the jewels. The jewels are dropped if defective into open *N G*, or into *O K*, if all right. The little circles indicate how the jewels rest upon the table *F* before they have been inspected.

Pittsburg, Penn. E. LAWRENZ.

Copper Hydraulic Bushings

The method of lining the cylinder of a hydraulic press with a brass bushing, as shown by Charles Markel on page 772, Volume 33, Part 2, is interesting and ingenious; but whether or not it would be successful in every case is doubtful. To get a brass bushing that is turned and bored and not leak at the usual pressures in hydraulic cylinders (from 2000 to 6000 pounds per square inch), must be considered a great piece of luck. The slightest leak through the bushing will cause it to bulge out into the cylinder or be otherwise dislodged.

The sketch, Fig. 1, shows a method that would be cheaper and more efficient. The lining is a sheet of copper about 3/16 inch thick in the rough. The length should be equal to the length of cylinder, and the breadth enough less than the circumference of the ram to allow for boring. If the cylinder is to be bored, it would be best to make the lining first and bore to suit. This sheet is rolled to a cylinder; the edges are brought together and brazed. One end should be squared with a file and this end should enter the cylinder first. If the copper lining is too tight, it may be driven in by sledging on a heavy block of iron, but preferably on a block cut out as shown by Fig. 3. If the lining sticks, take the whole outfit to the press and force it home. This will take about five tons.

The lining is then rolled out to fit the cylinder snugly, by a roller about 4 inches diameter and 1 inch thick and having a rounded face. Considerable pressure should be applied with about ⅛ feed. After running over the surface several times with the roller, it should be tapped with a hammer all over to see that it is solid with the cylinder.

A tool bent like Fig. 2, with a good deal of edge, should be used in boring. This will give the chips plenty of room to come off freely. The work may be run fast, but feed slowly. Allow for a very light finish cut.

The lining should then be polished, first with coarse emery cloth. Use oil in polishing operations from start to finish. This prevents grains of metal from adhering to the cloth and scratching. Finish off with fine emery cloth. A mirror-like polish may be obtained in this way.

The packing for the bottom of cylinder is shown in Fig. 1. The leather is soaked in water, then pressed into a die of the same diameter as the ram. It is allowed to remain in the die over night. The lip is then trimmed to a fine edge. The plate may be made of brass and threaded for pipe connection through the bottom of cylinder. The plate should be placed in the leather and then inserted in the cylinder. Make the plate large enough to pinch the leather tight against the lining.

No holes should be drilled through the lining, as this is sure to cause a leak between the lining and cylinder.

In some cases the rams of hydraulic cylinders are covered with a copper sleeve. This is necessary because the supply from pumps is often mixed with impurities, which cause the rams to rust rapidly. The sleeve is made like the one just described, but it has a cap brazed on one end. This end of the sleeve is spun over, and a round sheet of copper placed on this and brazed. The sleeve should go on the ram easily.

To make the sleeve hug the ram tight, the ring shown in Fig. 4 is used. This is about 2 inches square in section with the bore rounded. This ring should fit as tightly as possible. Do not hammer at one side and then diametrically opposite. Start sledging at one point, and gradually move around until the whole length of the ram has been covered. Have a ring made of 4-inch belting to protect the sleeve from the sledge. Finish the sleeve the same way as the lining.

The end of the ram should be tinned around the center for soldering. Make a plug of copper to close up the end where lathe center goes through the lining. Screw this in tight and cover over with solder.

It might be as practicable to use rolled sheet brass, or spun brass and copper. One shop I know of used spun copper for presses used in experimenting on pressed peat bricks.

Chicago, Ill. FRANK THOMAS.

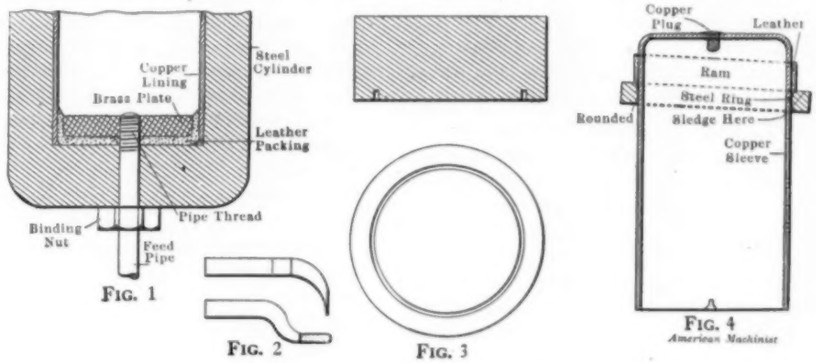


FIG. 1 FIG. 2 FIG. 3 FIG. 4
American Machinist

COPPER HYDRAULIC BUSHINGS

Consultation and Machine Design

Having read the article by Otto E. Sieffert, "Designing Special Machinery," on page 244, I agree with him that the drawings should be complete in every detail before being given to the mechanics. This is much better than having no drawing at all—and working only on suggestions from someone else, and having a dispute if things do not come out the way they should.

If toolmakers were to have the theoretical knowledge which Mr. Sieffert says they have not, they would cease to be toolmakers and become designers. In my 25 years experience as machinist, toolmaker and manufacturer I have never found conditions yet, where a designer could consult so many different people, and arrive at any conclusion whatever.

I have one instance in mind of having charge of building a machine, designed by a man, who had no previous experience in the same line of machines before, which when finished, did better work and increased the production 14 times over the machines then in use. There was not a change made in a drawing, and the only time the mechanics saw the designer was when he came in the shop to look around and see how things were progressing. Special machinery as a rule is made to cheapen the production of a certain article. The person in charge generally picks out a boy or man, not necessarily a mechanic, whom he thinks will make good, and by constant application and practice on the same work becomes expert. About all he would be required to know about the machine would be to report breakdowns and faulty material, but would be of little use to the designer as far as making suggestions regarding the machine.

In my opinion a designer if he is one, and not a near one as many are, should stand or fall alone on his own merits.

Camden, N. J. H. F. COOPTRANFT.

Correcting Wrongly Drilled Holes

An article on page 72, under the heading of "Correcting Wrongly Drilled Holes," I think deserves criticism. I am quite sure that H. R. G. is mistaken in this method of correcting wrongly drilled holes and, while I may not be an authority on such things, I will guarantee that if you try what he says, you can't do it.

No drill, I dare say, will cut ⅛ or ¼ of its size on one side without running or breaking, yet H. R. G. says, run "the drill through and the mistake is satisfactorily corrected in a jiffy." If you think I am wrong, try it, and watch the drill break or run over into the full sized hole.

Detroit, Mich. LINTON COLLINS.

Comparing the Cadillac and United States Standard Threads

The article by A. D. Elmer, page 211, is of considerable interest to all who have to do with accurate thread work. Mr. Elmer's connection with a firm well known for the high standard of their mechanical work, gives weight to his argument, and might cause many who have not had the opportunity for actual experience in the matter to have a poor opinion of the United States Standard thread, and to retard the adoption of this thread form in some places.

The Cadillac thread is all right for the Cadillac Motor Car Company, because they started out by using V-thread taps of a certain make, and when they got into the troubles sure to be met with, they eliminated the causes of several of these troubles in the scientific manner described, and retained their original V-thread pitch diameter, but its farther introduction would only complicate the present condition of affairs and do absolutely no good to anyone.

The United States Standard form of thread is particularly adapted to all the requirements of accurate and economical manufacturing, if it is intelligently used, and it is rapidly replacing the old V-thread system for which there is no standard. I think it safe to say that about 90 per cent. of the large manufacturing concerns in this country have adopted it with satisfactory results.

Fitting Threads Top and Bottom

Mr. Elmer's statements in regard to the United State Standard threads fitting on top and bottom, as well as on the sides, seem to indicate that his view of this matter is different from anything I ever heard before. It seems scarcely possible that anyone could consider such a proposition. Referring to this matter he says, "Nothing is accomplished by having this thread fit on the flat. It is impossible to produce it in practical manufacturing; and, that it has been abandoned is proved by the fact that many of the tap and die makers have enlarged the outside diameter of their taps, while maintaining the original pitch line."

I never heard of anyone attempting to make threads fit on the top and bottom, and certainly no tap maker ever intended his taps to cut so that screws would fit that way, so they have abandoned nothing on that score. Most of them have always made the outside diameter over standard size, and they have not maintained the original pitch line, but have increased that also. In our factory taps that are not over standard in both measurements are thrown into the scrap.

Taps Made Oversize

We make the pitch diameter of our regular taps a certain amount oversize for each diameter, running from about 0.001 inch on small taps up to 0.005 inch at 2 inches diameter, with the outside measurement about 50 per cent. more over standard than the pitch diameter.

We must follow some rule like this, because our uptodate customers try their tapped holes with United States Standard thread plug gages and throw away the taps as worn out when the gages will not screw in. Now it is evident that our customers understand this matter as we do, that the United States Standard is the size for screws, and taps must not be United States Standard size, but a size that will make a satisfactory fit for standard screws.

It may be claimed that the United States Standard system is incomplete because there should be a minimum limit for screws below standard and a maximum for taps above standard, but wno can set limits that will satisfy the varying requirements of all classes of mechanical work? Taps which produce the close fits demanded by some will be rejected as too small to use by others, and there is frequently good reason for the difference of opinion on account of varying conditions. One of our best customers refuses to accept nut taps with their pitch diameter more than 0.002 inch over United States Standard size, while this same amount over standard is the low limit of many and some will not accept taps less than 0.005 inch over.

Necessity for Variable Limits

A little thought will show that this condition will never be entirely done away with. Nothing proves this better than Mr. Elmer's criticism of the American Society of Mechanical Engineers' standard for screws and taps. Here is a system with standards for both screws and taps and limits of variation all complete, worked out by leading mechanical men and approved by large numbers who are now using it, but rejected by Mr. Elmer and quite a number of others, who immediately set up some new standard of their own for either the screws or the taps or both.

Mr. Elmer is entirely right in wanting clearance at the top and bottom of the threads when screwed together, but he can get it just as well with any other system as with the Cadillac standard, and the United States Standard thread is especially adapted to this kind of a fit, for which it was, no doubt, designed in the beginning. The Cadillac rules providing for this clearance are all right in principle, but if generally adopted, would be changed to meet individual requirements and notions just as all other standards have been. In my own case, I would immediately reduce some of the extra and useless clearance, so the top of the thread on the tap and in the die would not be so sharp, because the very sharp threads get dull much quicker than the flat ones.

Hardening Sharp V-threads

In discussing the V-thread, Mr. Elmer says, "Theoretically, the V-form of thread is incorrect, because the tap and die will not pass through fire and water while in the process of hardening and maintain a sharp V at the top and bottom."

This is entirely wrong. There is not a particle of trouble in properly hardening either taps or dies with the sharpest thread that can be formed. The trouble is that the theoretical V-thread cannot be cut at all. It should be perfectly plain that the V-thread formula leads to absolute sharpness, which is a little bit sharper than a razor. Using a single point V-thread tool it will be found that the outside diameter of a screw will be reduced about 0.002 inch below standard when the theoretical pitch line has been reached, and the thread thus formed is so sharp on top that a tap finished this way will be reduced about 0.002 inch more by the first piece tapped. The diameter at the root of the thread will be found to be as much as 0.003 inch over the theoretical figures, proving that we cannot grind a tool to the degree of sharpness required.

Why Pitch Diameters Were Increased

Naturally the tapmakers learned these things in their A B C days and increased the pitch diameter of their taps to what they considered practicable working figures, and also increased the outside diameter, because, as I have already stated, they always believed that clearance was required above the screw threads. Working independently and supplying different classes of trade, it is not surprising that our V-thread standards differed. In the meantime catalogs and reference books give the figure for the theoretical pitch diameter of V-threads, with no information to the fact that the published figures cannot be worked to, so every little while it is necessary for us to explain this whole matter to someone who is just getting uptodate to use thread micrometers, and it is sometimes hard to convince them that the authorities quoted can be wrong or incomplete in their explanations.

I note that in Mr. Elmer's table No. 1, showing the Cadillac adaptation of the of the American Society of Mechanical Engineers' standards, the maximum pitch diameter of the screws is greater than the minimum of the taps. The sloppy fits he refers to, as the result of using the genuine American Society of Mechanical Engineers' standard sizes with their limits of variation would be more satisfactory

to most than the fit we would get with this combination.

In referring to the American Society of Mechanical Engineers' standards, it is well to bear in mind that the maximum screw sizes and the minimum tap sizes are standard for their respective classes, and those who require good fits will work close to these figures.

JOHN E. WINTER,
President and Manager Winter Brothers Company.
Wrentham, Mass.

Checking Pyrometers in Service

R. W. Davenport in his article on page 67, makes the following statement: "The moving coil of copper wire in the meter changes in resistance with any change in its temperature. The amount of current it carries determines the meter's reading, and since, if the resistance increases, less current will be allowed to flow, a rise in the meter's temperature will lower its reading, irrespective of the temperature at the hot end of the couple. In some designs this error may reach as high as 3 per cent. for every 10 degrees Fahrenheit rise or fall in the temperature of the meter."

When we stop to consider that the error in question is due to the temperature coëfficient of copper, it is obvious that the percentage mentioned is impossible. The temperature coëfficient of copper, as used by various engineers, varies from 3.94 per cent. to 4.28 per cent. for 10 degrees Centigrade. The value most used is 4 per cent. for 10 degrees Centigrade or 2.22 + per cent. for 10 degrees Fahrenheit. Now, the percentage of error of a thermo-electric pyrometer due to the temperature coëfficient of the meter coil would be that of the copper of the coil, that is, 2.22 per cent. for 10 degrees Fahrenheit, if the meter coil comprised the total circuit. This, however, is not the case. All manufacturers of thermo-electric pyrometers use an adjusting resistance to calibrate the couples to the meter, or *vice versa*. This resistance may be placed on the couple in the leads, or in the meter itself. The percentage of the total resistance of the current, which is in the moving coil, varies from 10 per cent. to 80 per cent. in various types on the market today. Therefore the error due to the temperature coëfficient of the meter coil is expressed thus:

$$\frac{\textit{Resistance of meter coil}}{\textit{Total resistance}} \times 2.22 \textit{ per cent.} =$$

the percentage of error for 10 degrees Fahrenheit. Thus, for a pyrometer in which the meter coil is 10 per cent. of the total resistance, the error would be 0.22 + per cent. for 10 degrees Fahrenheit, and for an outfit with 80 per cent. of the total resistance in the meter coil, the error would be 1.77 + per cent. for 10 degrees Fahrenheit.

If the meter coil were the total resistance of the circuit, then the error would attain its extreme value of 2.22 + per cent. of 10 degrlees Fahrenheit, but it could never, under any circumstances, reach the value of 3 per cent. for 10 degrees Fahrenheit.

G. S. VAN NORMAN.
Detroit, Mich.

Beating the Inspector on Steel Tests

Mr. Williams has told a very true tale on page 41, under the above title, only I am pretty sure that such reprehensible methods have not been confined to the period of the early nineties, and, indeed, that they are practised successfully by some firms even at the present day, in spite of the increased vigilance of inspectors and inevitable exposure which some day or other will ruin each of these firms. Unfortunately such frauds are not easily found out, as they are usually practised with a skill which could undoubtedly be better and in the end, more profitably employed.

Mr. Williams advises inspectors to watch their test pieces all the way from the shears to the testing machine, but surely a little consideration will convince him that such a course is absolutely impossible. The test piece after being cut from the bar has to be turned to the standard size in a lathe, and this operation alone takes a few hours, and no inspector who is reasonably employed can afford the time to sit tight on his test pieces until they are pulled. In the case of tires, axles, forgings or castings, where the test piece has to be slotted from the body of the metal before being turned the time occupied is very much longer, and it becomes more hopelessly impossible for the inspector to stick by his test pieces. Why, most inspectors have a dozen visits or so to make in a day to different firms, and we humans are not omnipresent and all that an inspector can do is to take all reasonable precaution and let it go at that. He cannot be blamed and is guilty of no neglect if the manufacturer is deceitful enough to false-mark, and vile enough to send away bad material—and he may rest assured that if they do these things they will be found out in the end.

I remember being sent out by my firm to test and inspect 250 volute springs. I was young and inexperienced, but was most cordially received by the manager of the works, and was handed from one official to another until I reached the spring shop. Here a chair was offered to me in front of the "scrag" and I sat down and measured the springs as they were brought to me. Something prompted me to count them as they were brought up, and when I had got to about 120 the foreman came and said I had seen the lot. I, of course, spotted something wrong, as it was absurd for me to suppose that I had made such a gross error in counting, even although my attention was taken up partly with measuring and it then struck me that the springs had been brought up from behind my back, and taken behind me again after being tested, so that I couldn't say whether I had seen 120 different springs or just a few over and over again; so I then and there determined to go through the whole lot again. The foreman was angry and sent for the manager, and they both stormed and said nasty things—which only made me the more pigheaded, and in the end they had to give in.

My suspicions must have been well founded, because all but a few springs in the retesting showed a permanent set: Needless to say I reported the maker to my chief and they were crossed off our list.

There is something to be said in sympathy for the manufacturers of steel, generally, for there is no doubt that there is a tendency for engineers, although not steel experts, to impose more and more stringent tests, and at the same time specify certain limitations in the method of manufacture which make the manufacturers' task such a difficult one that he must in some cases either refuse the specification and the work, or get out of it as indicated by Mr. Williams. He is truly between the devil and the deep sea. But, as I have said, in the end honesty is the best policy.

Birmingham, Eng. CONAM.

Why Are Not Prices Published?

With his usual degree of logic, our friend, John R. Godfrey, again hits the nail on the head in his article regarding the publication of machinery prices.

It appears that there is a division in the matter of price publicity and nerve to make one price and stick to it, between the machine-tool trade and the builders of motive-power machinery. This is evidenced by his example of the ceremony required to get the price of an electric motor. I have some first-hand experience in this line to offer.

For several years I was connected with a firm of manufacturers of power machinery. When located at the shops, even in the engineering department, prices of the goods we were making were absolute mysteries. In fact, we no more would have dared to ask the price of any machine than to ask a spinster her age. Either question would be equally presumptuous.

Later, when made one of the staff of the general office, although all of my duties were to be in the line of price quoting on special outfits, a very considerable amount of the "high sign" busi-

ness had to be gone through with before I was intrusted with a price list, with strict orders to keep the lid down tight. In cases where prices had to be made for special equipments from manufacturing costs of similar units, only the chief of the department was allowed to rest his eyes upon a cost sheet and he had risen to that holy state solely by long years of faithful secrecy. Furthermore, he was the only man in such a position who had this sacred privilege and consequently was looked upon with jealousy and suspicion by many of the sales-department men, none of whom, even the branch managers, were permitted to know these manufacturing costs nor the profit thereon.

How prices were made by the cost department for special units became somewhat of a joke because, while they performed their black art behind a ground-glass partition through the door of which nobody of any other department was allowed to pass; we, of the engineering department, used to annoy these cost men by insisting upon "guessing" the price before they told us. They often were aghast when we guessed within a few dollars with the help of a slide rule. Our method was to obtain the weight of units previously built and multiply by a price per pound, while the cost department used some ritual of cabalistic signs to get their prices.

Of this system "the worst is yet to come." There actually was a salesman in their principal office who boasted that he had sold many a machine at list price, when the customer was entitled to 20 per cent. discount. He was afterward sent out to establish and be general manager of a new, far-eastern branch. Such is the reward of virtue!

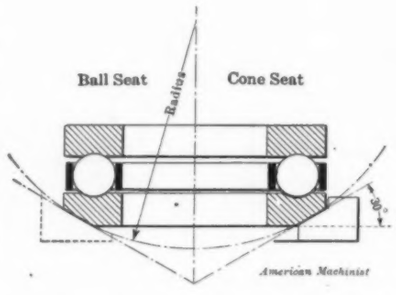
This same man knew the bargain hunter too; the man of whom Mr. Godfrey speaks as absolutely refusing to buy without a special discount "to him." The salesman seemed to know such a man by the cut of his jib and his invariable custom was to raise the price at least 5 per cent., then go in and haggle with the bargain hunter, resulting in many instances in a concession of perhaps 3 per cent. This left the "bargain price" still 2 per cent. above the regular price; that is, if he had not already neglected to give the customer the benefit of the 20 per cent. discount to which he was supposed to be entitled!

Philadelphia, Penn. R. S. HARRINGTON.

Ball Thrust Bearings with Cone Seats

In recent issues the construction of ball thrust bearings with ball seats is discussed. According to them, it appears to be generally unknown that some firms have for a long time equipped ball-thrust bearings with cone seats. The cone seat has preponderant practical advantages over the ball seat, although it must be admitted that by pure theory the ball surface is the more perfect. I will state the reasons why the design of the lower bearing ring with an oblique surface less than 30 degrees, therefore, a cone seat, is the more practical.

It is known that with ball-thrust bearings an adjusting ring is always furnished. This is absolutely necessary since most purchasers have not the appliances to make such a ring with sufficient accuracy to fit. On the contrary, a cone-seat surface less than 30 degrees can easily be made with sufficient accuracy on any lathe, so that in most cases it is not necessary to build a special ring into the housing. It is, moreover, a well



BALL THRUST BEARING WITH CONE SEAT

known experience that a machine is less sensitive and more durable the fewer are the parts of its mechanism. The cone seats lead to exactly the same results as the ball seats. Both designs (cone and ball seats) are intended for an automatic rectilinear adjustment of the bearing to the shaft, whereby inaccuracies are equalized, and before all things, a regular distribution of all the load on all the balls of the bearing is attained.

Thus the difference between ball and cone seats is only theoretical, since a tangent line less than 30 degrees almost coincides with the bearing surface of the corresponding spherical seat, as the accompanying sketch shows.

With the cone seat it is further possible to center this ring of the bearing support, which for a vertical arrangement of the bearing is of the greatest importance.

Long years of practical experience have shown that in every respect the ball bearing with a cone seat works as well as one with a ball seat.

THEODORE BULLING.

Leipzig-Plagwitz.

Keyseating on the Planer

The article, page 257, Volume 34, "An Extemporized Draw Stroke Shaper," suggested the following description of a keyseating fixture for the planer, shown in the line cut, which I made some six years ago for cutting a 5/8-inch keyseat through both hubs of a drum 13½ inches long and 1½-inch bore, at the rate of 2½ per hour.

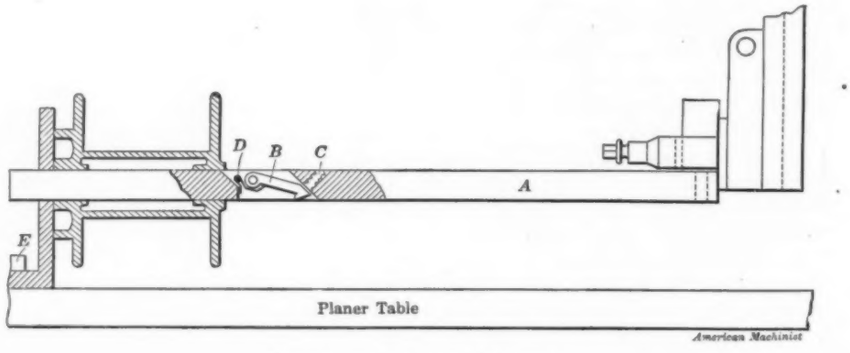
A piece of shaft *A*, 1½ inches diameter and 32 inches long, was taken and fitted with a flat shank so that it could be clamped in the tool post as shown, with the end of the shaft firmly against the tool-post washer. Near the middle of the shaft a slot 5/8 inch wide was made and the tool-steel cutter *B* was fitted closely into the slot so as to be held against the feed screw *C* by the small spring *D*.

In use, the shaft is supported parallel with the table by the hole in the angle plate *E* against which the work is also clamped; the planer is then started and at each stroke, when the tool comes out, the workman reaches in and turns screw *C* with a screwdriver which feeds the tool downward.

Since this fixture was made, we have frequently used it for cutting keyseats in larger bores than the diameter of the shaft *A*, by supporting the outer end as shown, and setting the work so as to bring the lower side of the bore in contact with the lower side of the shaft, and we have no chattering, for while the shaft is in compression during the cutting stroke the tool is in tension, and any spring of the shaft tends to relieve the cut.

WILLIAM A. FRANK.

Jersey City, N. J.



KEYSEATING ON THE PLANER

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American Machinist

Reducing Occupational Diseases

One of the most serious occupational diseases, that of poisoning in match factories, due to the use of white sulphur, promises to be entirely abolished in this country. This has come about by the Diamond Match Company, commonly known as the "match trust," formally renouncing the patent which prevented its competitors using the non-poisonous substitute which it controls. This patent has been made absolutely free for the use of persons within the United States.

This renunciation of patent rights includes the returning of license fees to those who demanded it, although most of the licensees gladly gave what had already been paid as their contribution toward the abolition of poisoning due to this cause. This action on the part of the Diamond Match Company removes the last objection to the bill introduced in Congress by Mr. Esch, of Wisconsin, for the purpose of abolishing the manufacture of the present poisonous style of match.

This marks a decided advance in the way of disease prevention, and the Diamond Match Company is to be heartily commended for the stand it has taken. This was brought about by a request from President Taft and allows the free use of its patent for a style of match which does not call for material that is poisonous to those engaged in the manufacture. While there are perhaps few places where a similar action would give such beneficial results, there are many smaller opportunities for proving that we have a real interest in the welfare of the workers on which our ultimate prosperity so largely depends.

Facts About European Trade

There are many conflicting ideas afloat with regard to the possibility of securing European business, and we sometimes overlook facts which would seem almost self-evident.

It is hardly to be expected that plain, standard machines, such as lathes and planers, will be sold to any large extent in Germany, except under special conditions. But there still remains quite a field for the more special machines, such as semi-automatics and screw machines.

Neither should we be discouraged at the hold Germany has on the territory immediately surrounding her own country. Most of the engineers in Austria-Hungary, northern Italy, portions of Switzerland and western Russia have been educated in Germany, speak the German language and are accustomed to German machines and methods. This gives the Germans advantages in many ways, but the special machines have a field even here and can be sold with proper representation.

Russia possibly presents the best field at the present time, both on account of her enormous size and the fact that she is just beginning to manufacture along different lines. From all appearances the time is ripe for starting a vigorous selling campaign by first becoming thoroughly familiar with all the conditions and then securing proper representation by Russian-speaking salesmen.

Machine Shop Lighting

One of the major articles in this week's issue deals with the important subject of machine-shop lighting. This subject is peculiarly important at the present time, from the change that is working out in the method of such lighting, this change being brought by the application of the new high-efficiency units.

The usual machine-shop lighting is a combination of two systems; arc lights are distributed at intervals over the manufacturing area, furnishing what is referred to as general illumination. At the same time individual incandescent lamps are provided for each machine tool and each bench space. There are several serious disadvantages in each of these systems and in the combination, as pointed out in the article to which we have referred.

By contrast, the newer system employs a number of individuals or clusters of high-efficiency lighting units, grouped over and in arrangement adapted to the particular work that is being done on the shop area beneath. This system promises far better illumination at a less cost of operation and maintenance than the older method.

In fact the advantages seem so important that not only should the designer of a new plant study it with considerable detail, but, further, many older plants can well consider the changing over of their present equipment.

Ample satisfactory illumination in the machine shop means greater production during the hours of darkness or semi-darkness outside, minimizes industrial accidents, and in other ways is directly to the advantage of both employer and employee. Modern factory building design calls for enormous window areas in order to provide the best of natural

light. By the same token the manager and engineer should provide for the best of artificial light.

Research Work in Technical Schools

One of the most attractive features of a position on the faculty of an engineering school is the opportunity for research work. In view of the large number of such schools, their extensive laboratories, and their brilliant men, there is a paucity of results that reach the public in spite of the fact that much such work is done, and that it is well paid for by individuals and corporations who wish it for their private use.

While we recognize that much of this work is of such a nature that the results published without the names of the persons furnishing the material tested, would be of little value, and also that much could not be published as comparative tests with names given, it does seem to us that so far as possible results of such work should be published. Whatever a manufacture may pay for having a machine tested in comparison with a competitor's goes most generally into the pockets of the one having the test made, the institution benefiting only indirectly.

All these institutions are in a measure charitable in that hardly one charges its students the full cost of their tuition. The funds to pay the remainder of this cost are, in a sense, public, as they have either been given by the community or by men who wished to benefit the community.

Hence it appears that a part at least of the cost of conducting research for private parties is being met by the public.

Again, theoretically, this private research work is supposed to broaden the mind of the professor conducting it, and through him to affect the students favorably. If this testing or other investigating was done openly and the students expected or allowed to assist, it would certainly have a beneficial effect. Too often it appears that students are excluded from this work for one of three reasons, one that the interested parties are fearful that information may leak out, another that students may be careless and the last that student work is slow, due to the small number of consecutive hours that students are in the laboratories.

It seems fair to assume that the arrangement of hours could be well changed to give greater continuity to students' work and also that it would be decidedly to their adantage to be given work which must be accurate in order to satisfy commercial conditions. Graduates spend some time in discovering the need of care and the absolute necessity of checking their own work. If they could discover that same necessity before graduation it would be to the advantage of the world into which they are about to enter as well as themselves. As for the first objection, it does not seem right that a public or semi-public institution should do work of so private a character that the students cannot be allowed to see it.

Worcester Metal Trade Meeting

The ninth annual banquet of the Worcester branch of the National Metal Trade Association was held at the Bay State House, Worcester, Mass., on the evening of March 16. The addresses were made by Ex-Congressman Charles G. Washburn and Harrington Emerson, the former discussing national legislation and the latter efficiency in shop operation.

The officers for the ensuing year are: President, A. E. Newton; vice-president, John W. Higgins; treasurer, A. W. Beaman, and secretary, Donald Tulloch.

There were over 200 members and guests present, and a lively discussion followed the address by Mr. Emerson, all seeming anxious to secure as much information as possible on the question of efficiency.

It was interesting to note from the necrology of the year that each of the three members who died since the last meeting were over 80 years old. They were: Edwin T. Marble, Charles H. Morgan and Dexter Harrington.

New Publications

Pocketbook of Mechanical Engineering. By Charles M. Sames. Fourth edition; 220 4x6⅝-inch pages; 40 illustrations in the text; indexed; bound in flexible leather. C. M. Sames, 542 Bramhall Avenue, Jersey City, N. J. Price $2 postpaid.

This fourth edition of a well known mechanical engineering pocketbook needs but little by way of review, except to mention that new material has been added on nearly 100 subjects. These deal with newer developments and make the work an uptodate reference book in the field of mechanical engineering, and furthermore a reference book in very compact form.

The Speed and Power of Ships. By D. W. Taylor. Volume I, 304 6x9-inch pages; indexed. Volume II, 119 9x12-inch pages, comprising 15 tables and 227 diagrams. John Wiley & Sons, New York City. Price $7.50 net.

This work, intended for the use of students, treats of the theory or resistance and propulsion of vessels, and gives methods, rules and formulas for the work of practical design. It is based largely upon the model experiments conducted nearly half a century ago in England by William Froude, supplemented by results obtained at the United States Experimental Model Basin. The author has directed the investigations made in that basin for several years. The work is divided into five chapters, with these headings: Preliminary and General; Resistance; Propulsion; Trials and Their Analysis; The Powering of Ships.

Personals

Frank D. Clark has established an office in the Brisbane building, Buffalo, N. Y., and will do a consulting business along the lines of economic phases of factory organization.

W. C. Loree, general superintendent of the Pittsburg system of the Baltimore & Ohio Railroad, has been made general manager of the C. H. & D. Railway, with offices in Cincinnati, Ohio.

E. A. Peck, superintendent of the Pittsburg division of the Baltimore & Ohio Railway, has been promoted to the position of general superintendent left vacant by the resignation of W. C. Loree.

C. H. Baker, until recently assistant chief engineer of the Cos Cob power station, Cos Cob, has been appointed chief engineer of the Boston & Maine Railroad Zylonite power station, Adams, Massachusetts.

George W. Armstrong, an occasional contributor to our columns, has accepted the superintendency of the newly organized firm of the Lester & Wasley Company, Norwich, Conn., which is to engage in the manufacture of envelop machinery.

Ferdinand J. Rochow

Ferdinand J. Rochow, a mechanical engineer, died at his home in Brooklyn on Thursday, March 16, in his seventy-third year. In 1861, immediately after his arrival in New York, and hard put for something to do, he drafted a rotary pump on a piece of wrapping paper at his lodging place. This pump has been manufactured for 50 years, and it is said that no modification of his original design worthy of adoption has been found.

Cincinnati's Industries

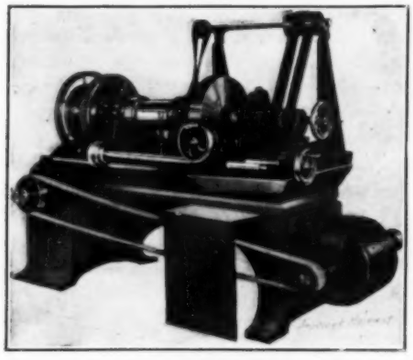
W. L. Schellenbach, chief engineer of the Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, gave a talk on March 17, before the boys in the Manual Training Department of the Hughes High School, on "The Industries of Cincinnati," in which he brought out among other facts of interest, that Cincinnati has twenty-six hundred factories employing over 82,000 workers; the invested capital in industrial lines being close to $200,000,000 and the amount annually paid in wages and salaries almost $45,000,000. The metal industry of the city alone employs over 15,000 men.

Shop Equipment News

Motor Driven Cutting Off Machine

The illustration shows a 5-inch, self-contained motor-driven cutting-off and centering machine. The machine is of the accelerated-speed type, and any standard constant-speed motor can be used by having the motor shaft extended to the proper length to take a pulley at each end from which to belt back upon the side pulleys of machine.

The centering attachment is driven from a short shaft under the main spindle, having at one end a sliding gear to mesh with one of the driving gears of the machine, and has a pulley from which to belt to the shaft on the top of the standards shown. This centering attachment is on a sliding base and pushes



MOTOR-DRIVEN CUTTING-OFF MACHINE

back out of the way when not in use. The centering spindle is hollow and the work end has a standard taper fit with suitable chuck for holding drills and countersink.

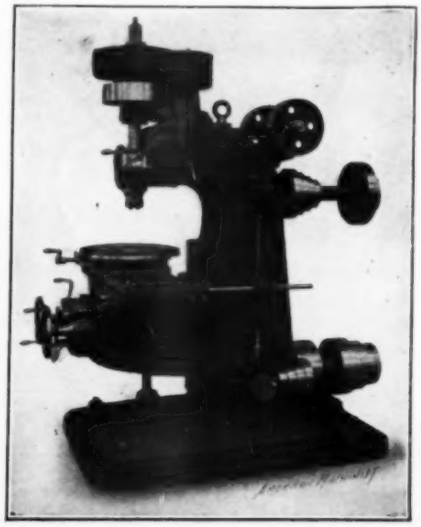
The machine is made by Hurlbut-Rogers Machine Company, South Sudbury, Mass.

A German Vertical Milling Machine

The machine has a column mounted on an oil pan. This was adopted as the oil pans were not cast uniform in thickness when cast with the column. The knee is of box section, the back ways have an extension projecting over the horizontal ways to insure rigidity. It is elevated by means of a crank on the left side, bevel gears and a telescopic screw. The vertical thrust is taken by ball bearings. The handwheels for operating the hand feed of the cross and longitudinal slide are in front of the knee. Locking devices are provided for the slides and

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German

knee. The power feed of 36 inches is transmitted by means of worm wheels and swinging worms operated by the handles underneath the hand wheels. The feeds have automatic trips. The circular table can be detached. The vertical and horizontal spindles transmitting the power feed to the table revolve only when needed as the driving gear on the vertical shaft in the gear nest can be engaged. The feeds are driven by the



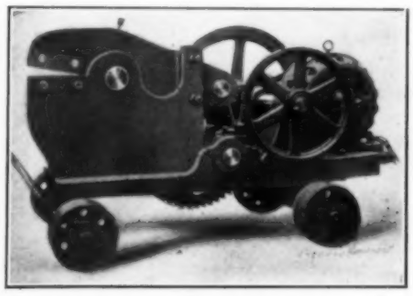
A GERMAN VERTICAL MILLER

countershaft by means of the two-step cone and the four-step cones. The four-step cones are of different sizes and can be exchanged, hence 16 feeds from 1½ to 27 inches per minutes in geometrical progression are available. The gear box at the bottom of the column contains the gears for reversing the feeds. The spindle head is counterbalanced and has a coarse and a fine hand feed and is provided with an adjustable stop with a micrometer screw for setting the depth of cut. The spindle 2¼ inches diameter runs in adjustable ball bearings. The belt pull is taken by a sleeve in the horizontal arm on the column. The back gears are incased. As the countershaft has two speeds, 12 spindle speeds are available from 20 to 500 per minute in geometric progression. The feed pulley on the countershaft is connected to the main driving pulleys in such a manner that the feed can only be thrown in when the milling spindle is running. This machine is built by H. Hassenmüller, Ludwigshaven, Germany.

Motor Driven Portable Shear

The portable shear shown herewith, manufactured by the Danville Foundry and Machine Company, Danville, Penn., requires but little description.

The machine shown is equipped with a 5-horsepower Westinghouse motor, and weighs complete about 4100 pounds. It is mounted on four wheels,



MOTOR-DRIVEN PORTABLE SHEAR

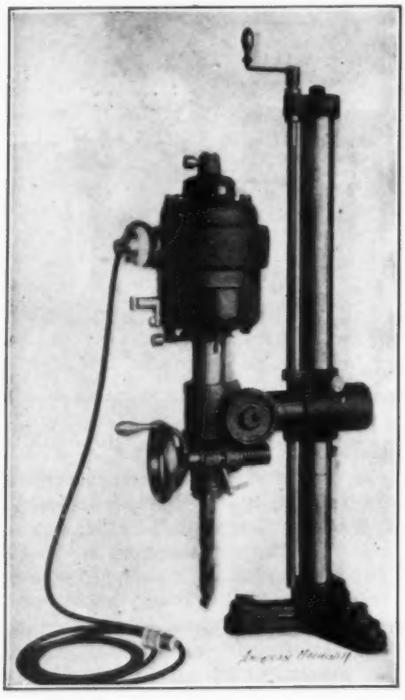
12 inches in diameter. Anti-friction roller bearings are used, permitting the shear to be easily moved by 3 or 4 men.

The knives are 10 inches long, having 4 cutting edges, and the jaws have an opening of 3½ inches at the mouth and ¾ inch at the heel. The blades can be operated at a speed of 50 cuts per minute, and the machine which is 3 feet wide by 5 feet 6 inches long, handles round iron or soft steel up to 1½ inches in diameter, while in the square material 1¼ inches is the maximum.

Electrically Driven Radial Drill

The electrically driven radial drill shown in the accompanying halftone weighs but 130 pounds and has a capacity of one-inch holes in any position. It is fitted with a two-speed gear change giving the speeds of 135 and 230 revolutions per minute. These changes are obtained instantly by shifting a small knob.

Length of spindle feed is 5 inches and spindle is fitted with No. 3 Morse taper. Current can be obtained from any lamp socket making the device very portable. Motors are wound for any kind of current, direct or alternating, or a direct- and an alternating-current motor can be used on the same drill.

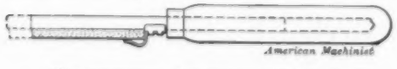


ELECTRICALLY DRIVEN RADIAL DRILL

The machine is a recent product of the Lamb Electric Company, Grand Rapids, Mich.

Telescopic Oilstone Holder

In this new style of holder the bar telescopes into the handle and projects outward long enough to hold an oilstone 4½ inches long, or can be compressed into the handle until only sufficient length is exposed to hold a stone 2 inches long. Stones of any length are thus held with equal convenience.



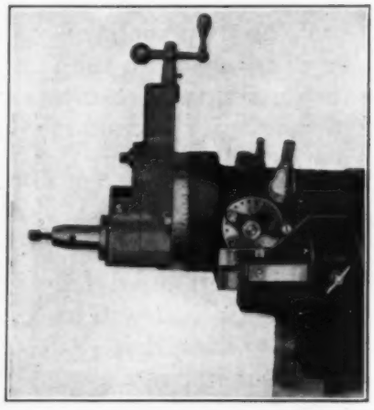
TELESCOPIC OILSTONE HOLDER

The tool is manufactured by F. J. Badge, 286 Taaffe place, Brooklyn, N. Y.

Variable Shaper Feed

The accompanying halftone shows the automatic variable feed as applied to the head of Rockland shapers by the Rockford Machine Tool Company, Rockford, Illinois.

It will be noted from the illustration that the arrangement has been designed with the view of simplicity, making it serviceable and not liable to get out of order. It feeds the tool either up or down and operates at any angle. The triangular-shaped incline on which the roller rides, can be readily adjusted to suit the position of the ram, or moved out of the way when not in use. The lever shown on the side of ram with spring pin regulates the amount of feed. Six changes are provided, as follows: 0.008, 0.016, 0.024, 0.032, 0.040 and 0.048. The lever on top of the ram reverses the feed and throws the gears out of mesh by placing lever in central position when not in use.



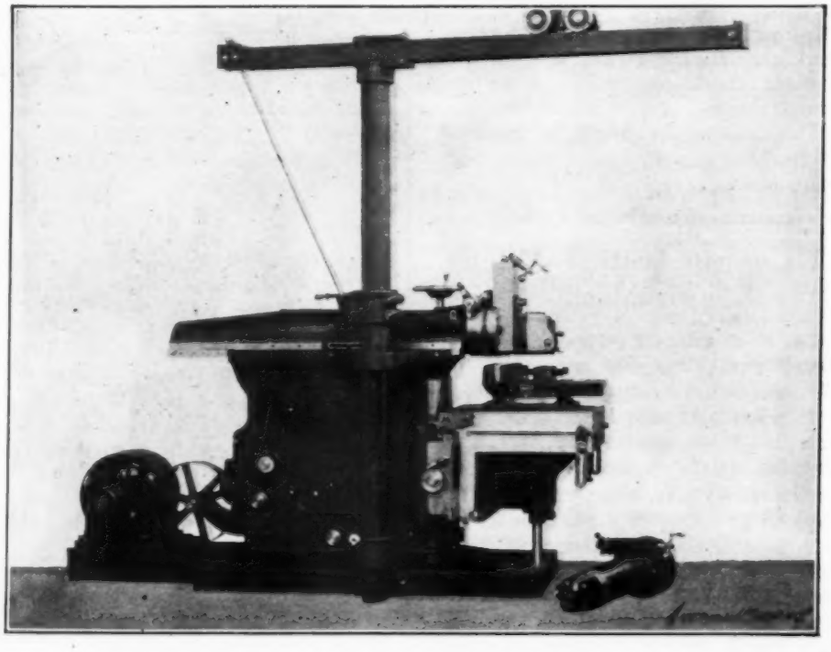
AUTOMATIC VARIABLE FEED FOR SHAPERS

Large Rotary Planer

A large type of rotary planing machine was recently developed by the Newton Machine Tool Works, Philadelphia, adapted especially for finishing cast-iron and structural-steel columns on both ends simultaneously. The machine is equipped with rotary cutters 26 inches in diameter, which are made of steel castings, with angular slots in which the cutting tools are inserted, and around the periphery of which is shrunk a steel band in which the retaining set screws are fitted. In the design of this machine the cutters are arranged to be pulled to the work which has a tendency to reduce chatter.

Shaper with Locomotive Outfit and Jib Crane

The accompanying illustration shows a 32-inch "Cincinnati" heavy-duty back-geared crank shaper, with special equipment, recently built by the Cincinnati Shaper Company, Cincinnati, O., and is of interest on account of the equipment furnished with it. This equipment included a constant-speed motor, of 10 horsepower, belt driven through gear box; a pull-cut head, with power-driven concaving attachment, as well as an extended circular feeding head, operating on the pull-cut principle, with both hand and power feed; a special knee table with tilting top, the top being 30 inches long and 24 inches wide; and a revolving jib crane of 1500 pounds capacity. On account of the hight of the crane, 9 feet, the illustration does not give a proper impression of the size of the machine; its weight is 9370 pounds.

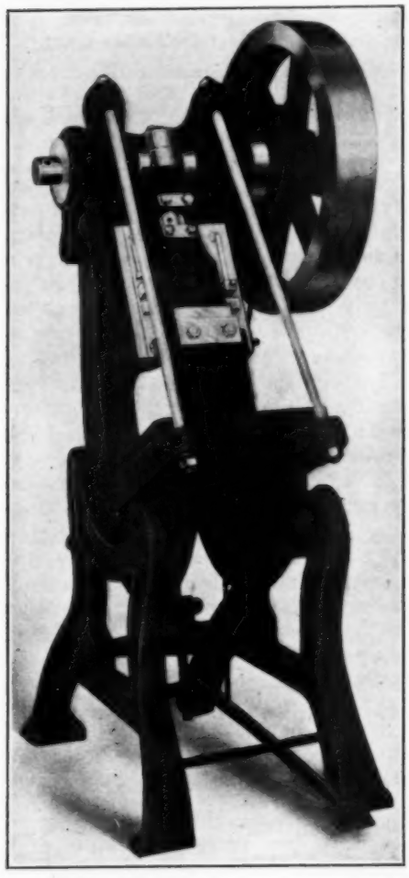


CINCINNATI SHAPER WITH LOCOMOTIVE OUTFIT AND JIB CRANE

Inclinable Open Back Press

The press shown in the accompanying halftone incorporates a number of improvements developed by the Fred. J. Swaine Manufacturing Company, St. Louis, Mo.

Inclining of the press does not raise the front of the bed to an awkward hight for the operator, as the swiveling point is at the front of the bed, thus keeping this part at the same hight whether the press is straight or inclined. A



INCLINABLE OPEN-BACK PRESS

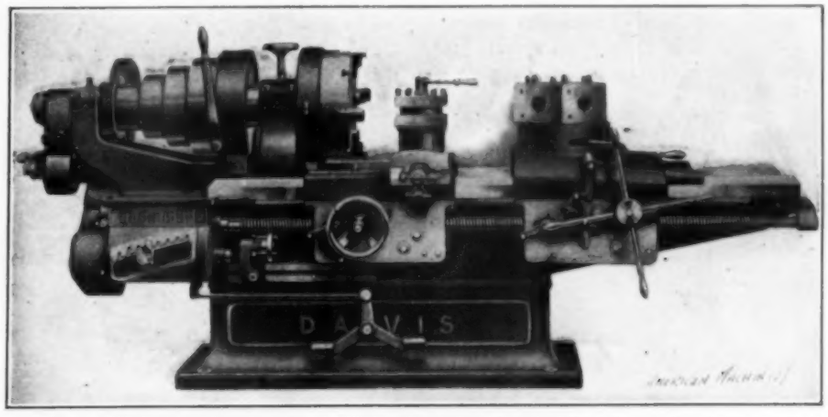
screw and nut is provided for raising and lowering the back of the press, the nut being made for the insertion of a round bar.

For setting of dies, the crank can be turned off center without stopping the flywheel, and it is not possible for the clutch to engage. After the dies are set the crank is turned back by hand to the starting point.

Vanadium steel is used in the clutch parts as well as for the shaft. Lugs for tie rods may be easily inserted or removed, and in this press the space from slide to bolster plate has been increased. Bearings and wearing surfaces are self-oiling, and an additional locking point for the clutch is furnished, thus permitting instantaneous operation, and insuring use of the press should one of the clutch bolts or connections break. This type of press is made in 11 sizes, geared or plain, weighing from 350 to 9500 pounds.

26-inch Turret Boring, Forming and Turning Machine

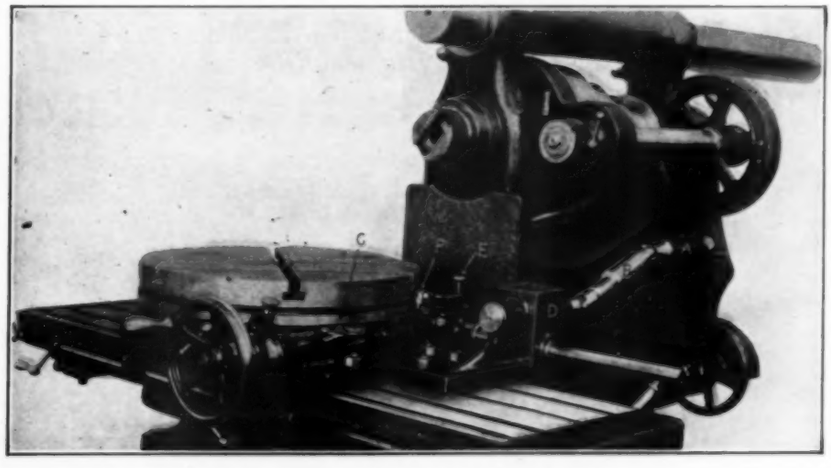
This is a machine recently placed on the market by the W. P. Davis Machine Company, Rochester, N. Y., incorporating several improvements, among which are a rearrangement of the driving mechanism, the addition of the gear-box drive



DAVIS 26-INCH TURRET, BORING, FORMING AND TURNING LATHE

similar to that used on engine lathes, and increase in the size of the hole in the spindle, which is 3⅛ inches.

The machine has a geared friction head and has positive drive with the back gears, and the triple gear meshes into the face-plate when desired. As



A CIRCULAR MILLING ATTACHMENT

will be noted the cone has four steps and these in connection with the two-speed countershaft and back gears give a wide range of speeds and feeds. The turret is 15 inches from face to face, 6 inches high and has six faces. Instantaneous change from one feed to another or one thread to another is possible with the quick-change gear box, which gives 32 changes, ranging from two to 32 threads per inch. The carriage has hand and power feed, an automatic stop for the longitudinal feed and has a cross-slide on which is mounted the four-sided turret or tool post, which is supplied with power cross-feed.

A Circular Milling Attachment

The halftone shows a new circular milling attachment which has been brought out by the Hendey Machine Company, Torrington, Conn. The bracket *A* carrying the universal shaft *B* is bolted direct to the body of the miller, the attachment being applicable to either the number 3 or 4 milling machines. The drive to the horizontal shaft *C* is by worm and worm wheel in the casing *D*.

The other end of the shaft *C* drives the worm shaft of the circular table through bevel gears. The power drive for the table is in either direction controlled by the lever *E* which has also a mid or neutral position when it is desired to turn the table by the hand wheel. The main worm can also be thrown out of engagement so that the table can be moved by hand.

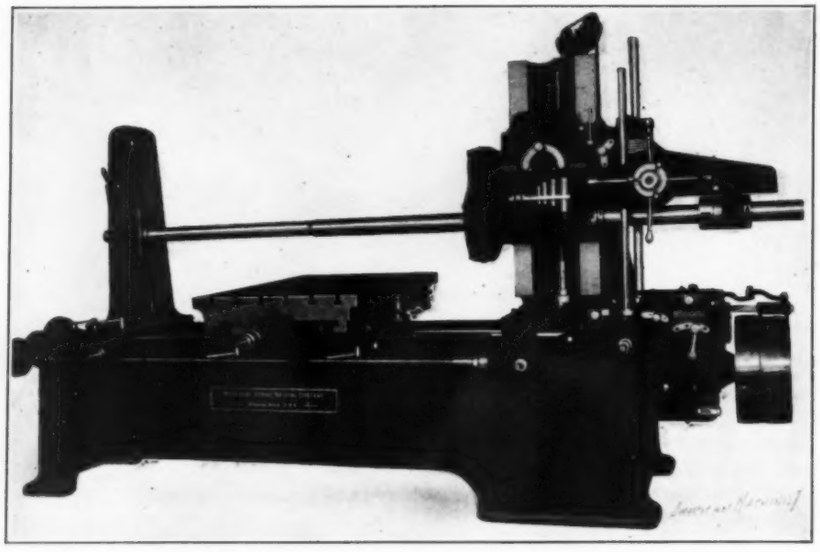
The table is 20 inches diameter, pro-

vided with four T-slots, is graduated to degrees and is provided with a T-slot *G* for the trip dog *F* which can be set to stop the table at any point with the feed in either direction.

The regular feed box is used and with it 21 gradations of circular feeds may be obtained. When not required the attachment can readily be removed in a few minutes.

Universal Horizontal Boring Machine

The accompanying illustration shows a new No. 3 size of the universal horizontal boring machine, recently placed on the market by the Universal Boring Machine Company, Hudson, Mass. This No. 3 machine they term their 3x30x30-inch, which refers to the size and travel of the boring bar; the machine has a 3-inch bar, a vertical feed of 30 inches and a horizontal travel of 30 inches.



UNIVERSAL HORIZONTAL BORING MACHINE

As will be noted, this machine is of the constant-speed drive type, and it is adapted for either belt or motor drive. The construction is very rigid, the upright which supports the spindle head being of the box form, and the bed and saddle being so constructed as to give a maximum support to the table. The location of the operating levers and the hand wheel for the rapid adjustment of the boring bar, and the facilities for changing speeds and feeds are convenient.

The location of the driving gear, at a point nearest the work, practically eliminates the torsional strain of the spindle. It secures stiffness in large milling cutters, and at the same time eliminates chatter in taking heavy milling cuts.

The spindle head is completely self-oiling. The spindle proper is surrounded by an oil reservoir, the gears run in a bath of oil lubricated by the splash system.

The automatic feed to the table is transmitted from the feed-gear box through spiral gears and a jaw clutch. The spiral gear carries the nut for operating the table feed and when the lever at the right of the saddle is pulled out, the jaw clutch engages corresponding teeth in the hub of the spiral gear beneath the saddle, thus engaging the feed. Hand-crank feed with micrometer adjustment is furnished for the operation of the table for longitudinal and cross movement, as well as automatic feed.

The gear box contains the feed and speed-change gears, which are made of steel; these gears run in a bath of oil, providing sufficient lubrication, quiet running and long wear. Eight speed changes are secured from the gear box, and these are doubled at the head by the back-gear lever, giving a range from 15 to 200 revolutions per minute. There are nine feed changes in either direction for the head, one lever reversing or stopping all feeds and retaining their relation to each other. The feeds range from ¾ to 5½ inches per minute without reference to the speed of the spindle.

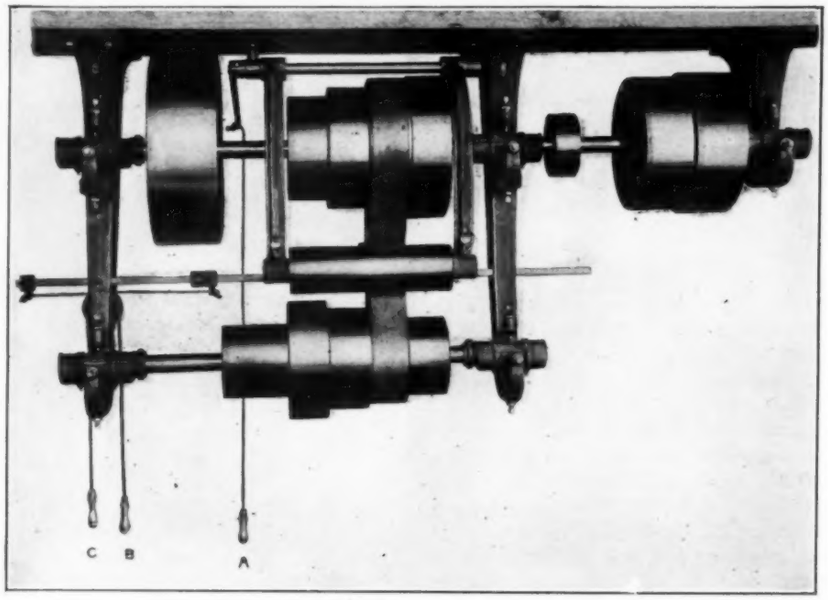
An automatic vertical milling feed, as well as an automatic, quick-raising and lowering feed are provided for the head, the boring bar has automatic feed in either direction, and the table has automatic cross and longitudinal feeds. The machine weighs about 10,000 pounds.

Variable Speed Ceiling Countershaft

The variable-speed countershaft described herewith gives four different cutting speeds with a constant high-return speed.

The drive consists primarily of two inversely placed cones; one mounted on the constant-speed shaft, which carries the return pulley; the other is mounted on the variable-speed shaft, which carries the cutting pulley. The constant-speed shaft is driven from the line shaft through a pair of tight and loose pulleys. The variable-speed shaft is driven from the constant-speed shaft through an endless belt.

To change the speed, it is merely necessary to pull the cord *A*, which raises "swinging idler" and thereby slackens the belt; then belt-shifting cords *B* or *C* are pulled, depending on whether the speed is to be increased or decreased. The "swinging idler," by its own weight, keeps the endless belt under the required driving tension, and also increases the arc of contact of the belt with the cone



VARIABLE-SPEED CEILING COUNTERSHAFT

pulleys. The belt is amply wide enough to easily transmit the full power of the planer. The momentum of the two cones, supplementing that of the heavy flywheel pulley, reduces the strain on the line-shaft belt at the moment of reversal. The tight and loose pulleys are of the differential type, so that there is practically no strain on the line-shaft belt when it is running on the loose pulleys. The small pulley, on the upper or constant-speed shaft, drives the power elevating device. The shafts run in large ring-oiling universally adjustable bearings. The idler is keyed to its shaft and the shaft runs in babbitted bearings lubricated by sight-feed oilers, and there is only one belt leading from the line shaft to the countershaft. The speed can be changed instantly, without shutting off the power or even stopping the planer. This countershaft has been developed by the G. A. Gray Company, Cincinnati, Ohio.

Hand Power Bending Tool

The machine shown herewith has been developed to be operated by one man, for bending reinforced rods cold. It is designed particularly to handle heavy stock

HAND-POWER BENDING TOOL

and will bend 1¼-inch bars cold. Rounds and flats can also be bent on this machine, and by substituting higher dies flat stock of 4-in. width or even wider can be handled. The jaws or dies of the machine are so arranged that they can be easily set to suit various sizes of bars.

The power is obtained by a lever which is operated by a ratchet in combination with a small pinion, which engages a series of cogs on the edge of the main frame of the machine, the gearing being on a ratio of about 8 to 1. The ratchet handle is 26 inches long

The lever is fitted with anti-friction rollers and all dies have tool-steel face plates at the corners.

The approximate weight of this machine, known as the No. 5 angle bender, is 268 pounds without stand. The stand weighs about 160 pounds. It is a recent product of the Wallace Supply Company, Chicago, Illinois.

Precision Bench Lathes

The accompanying illustrations show the precision bench lathe built by the Remington Tool and Machine Company, Boston, Mass., equipped with milling and turret attachments.

In general the machine has a heavy bed, internally ribbed, and has a spindle of the 2-angle type. The spindle takes 5- to 8-inch stock through self-centering spring collet chucks, and 3 to 4 inches through the live spindle when a universal chuck is used. The tailstock is provided with combination screw feed and lever feed of the spindle.

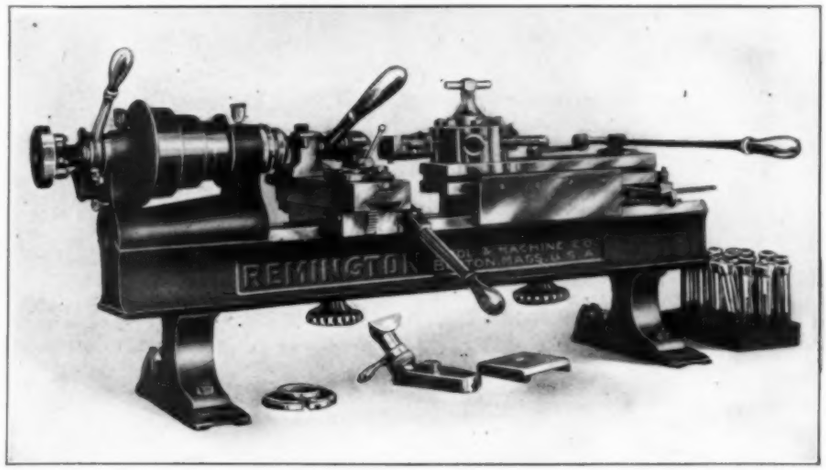


FIG. 1. REMINGTON PRECISION LATHE EQUIPPED WITH TURRET AND FORMING SLIDE

The turret attachment is shown in Fig.

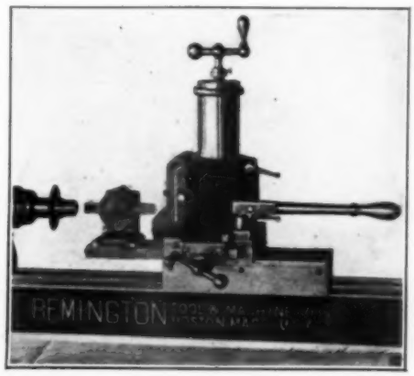
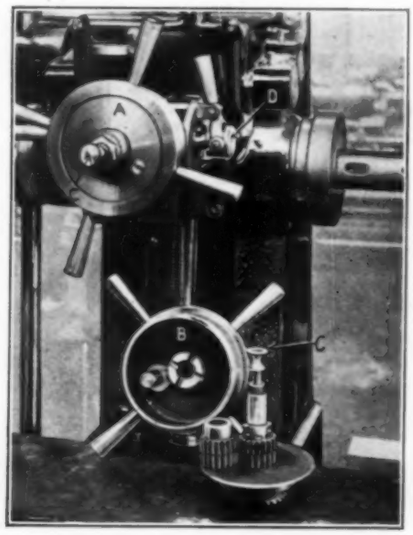


FIG. 2. MILLING ATTACHMENT ON PRECISION LATHE

1, and has a forming and cutting-off slide. The turret attachment has six holes and is provided with independent stops for each tool. The forming slide has a swivel tool post graduated in degrees so that straight forming cutters may be used in turning any degree of angle. Fig. 2 shows the milling attachment which can be used with lever as a hand-milling attachment or with ball-crank handle for screw feed. Grinding attachments for both inside and outside can also be furnished.

Quick Return Feed for Cleveland Horizontal Boring Mill

The Cleveland Machine Tool Works, Cleveland, Ohio, has equipped its horizontal boring mill with a quick return for the cutter bar, as shown in the halftone. *A* shows the feeding head in position on the machine, while *B* shows one disassembled, the quick return being obtained



QUICK-RETURN FEED FOR CLEVELAND HORIZONTAL BORING MACHINE

by pulling out the knob *C*, and operating the capstan by hand.

The clutch *D* is a little different from the usual run, as the teeth are beveled to an angle just below the slipping point, making the clutch very easy to engage or disengage, yet with no tendency to unlock itself.

This type of quick-return feed has been tested by the Cleveland Machine Tool Works and will be used on all future machines.

Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

Metal Working

NEW ENGLAND

The Whitins Machine Works, Whitinsville, Mass., will build an addition to its foundry.

The Taunton-New Bedford Copper Company, Taunton, Mass., is building a new machine shop.

The Gloucester (Mass.) Cold Storage Company has taken out a permit to build a new machine shop.

L. C. Clifford & Sons have leased a building in Greenfield, Mass., to manufacture welding torches.

The New York Central Iron Works, Geneva, N. Y., is arranging for building a new plant at Hagerstown, Md.

The Lynn (Mass.) Machine Company has been organized and will equip a plant for a general repair business.

The Barker Company, Pine Island, Norwalk, Conn., manufacturer of gasolene engines, will erect an addition.

The Taunton-New Bedford Copper Company, New Bedford, Mass., is to erect an addition to its machine shop.

H. J. Myers intends to open a plant at Auburn, R. I., where he will manufacture a gas machine recently patented by him.

The Manufacturers Foundry Company has awarded contract for the erection of an addition to its plant on Railroad Hill street, Waterbury, Conn.

The Fasnir Bearing Company, New Britain, Conn., has been incorporated with $100,000 capital to manufacture ball bearings. E. H. Cooper is secretary and treasurer.

The Worcester (Mass.) Welding Company has been incorporated for $10,000. Machines for welding will be manufactured. H. G. Woolison, Pittsfield, Mass., is president.

The Boston & Maine Railroad has decided to locate its new shops at North Billerica, Mass. The plant will occupy 530 acres and employ 1200 men. About $3,000,000 will be expended.

The Lester & Wasley Company, Inc., Norwich, Conn., has been incorporated for $25,000 to build "Leader" envelop machines and other light machinery. The incorporators and directors are Frederick W. Lester, Howard L. Stanton, George W. Armstrong, Percival W. Chapman and Frank H. Allen.

MIDDLE STATES

Fire destroyed Sanford Maxfield's machine shop at Fort Plain, N. Y.

The Globe Foundry, Grafton, Wis., was burned. Loss, about $20,000.

The Shirley (Ind.) Radiator and Foundry Company will enlarge its plant.

Fire destroyed the plant of the Ideal Motor Company, Lansing, Mich. Loss, $200,000.

Pugh Brothers, Providence, R. I., intend to building a large addition to their garage.

N. Krawitzky is having a garage built at Braddock and Clearfield streets, Philadelphia, Penn.

Jos. H. Burroughs is having a garage built at Tenth and Spruce streets, Philadelphia, Penn.

C. E. Platt is having a garage built at 1111 North Sixty-third street, Philadelphia, Penn.

The American Steel Foundries Company will build an addition to its plant at Chester, Penn.

The Republic Metal Ware Company, Buffalo, N. Y., will erect an addition to its plant.

John Jungers, of Grafton, Wis., will erect a stove and range plant to be electrically operated.

Myer Cravis is having a garage erected at Thirty-second and Morse streets, Philadelphia, Penn.

Joseph T. Ryerson & Sons Company, Chicago, Ill., will double the capacity of its babbitt foundry.

The Pennsylvania Shafting Company, of Royersford, Penn., is having an addition built to its plant.

The Rice Gas Engine Company, of 71 Broadway, New York, will erect a plant in Bordentown, N. J.

Preparations are being made by the Reading (Penn.) Iron Company to rebuild the Ninth street mills.

The Rome (N. Y.) Brass and Copper Company has let the contracts for a $100,000 tube mill at East Rome.

The Milwaukee (Wis.) Steel Foundry Company will erect a $17,000 plant on South Water and Virginia streets.

The plant of the Marion Motor Car Company, at Indianapolis, Ind., will be enlarged to twice its present capacity.

Abe Freeman, Atlantic City, N. J., will erect a warehouse and garage in the rear of his store on Atlantic avenue.

Spang, Chalfant & Co., of Pittsburg, Penn., manufacturers of tubing, have commenced the erection of a new machine shop in Etna.

The Olds Motor Works, Lansing, Mich., is planning an addition to its plant, which will increase present facilities by about 50 per cent.

Williamson Brothers, engineers, are building a six-story addition to their shops at Boston and Edgemont streets, Philadelphia, Penn.

The Berlin Machine Works, of Beloit, Wis., is seeking site on the Pacific coast for branch plant. The concern builds woodworking machinery.

The Architectural Iron Company, Cleveland, Ohio, has been incorporated by I. Trosman, A. T. Hall, etc., to build iron work for buildings.

H. W. Butterworth & Sons Company, Philadelphia, Penn., manufacturing textile machinery, will build an extension to its machine shop.

Moline Automobile Company, East Moline, Ill., will erect an addition to its machine shop. Company buys new machinery almost continuously.

Forsyth Brothers, Chicago, Ill., manufacturing metal sash and railroad supplies, will move to Harvey, Ill., where a new plant is being erected.

The Russell Automatic Gas Machine Company, Rockford, Ill., has been incorporated with $150,000 capital to manufacture gas machines, etc.

Lawrence Brothers, Sterling, Ill., will erect a $100,000 plant for which new machinery will be bought. Door hangers, hinges, etc., are manufactured.

A permit has been issued to the Empire Plow Company, Cleveland, Ohio, for a factory building, which will be used exclusively in the manufacture of plows.

Machine- and forge-shop equipment will be required for the new high school to be built in Hamilton, Ohio, which will be largely devoted to manual training work.

The plant of the Enterprise Manufacturing Company, Akron, Ohio, was gutted by fire. Loss, $25,000. The company manufactures metal specialties, fishing tackle.

Cleveland Auto Cycle Company, Cleveland, Ohio, has been incorporated to manufacture motor cycles and bicycles, by Roland A. Boskin, Henry C. Gabele, E. B. Rudolph, etc.

The Champion Keyless Lock Company, Chippewa Falls, Wis., has incorporated with $50,000 capital. Incorporators, John C. Hansen, Gustav Mueller and L. Steinberg.

Elmer Apperson, president of Apperson Brothers Automobile Company, Kokomo, Ind., is organizing a new company for the manufacture of motors, trucks and pleasure cars.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids April 11, for one radial drill for the Norfolk, Va., navy yard, as per Schedule 3436.

The Easy Trowel and Tool Company, Indianapolis, Ind., has been incorporated by Charles W. Fryburger, S. J. Rice and J. B. Runner, to manufacture trowels and machinery.

The Acklin Stamping Company has been incorporated by Graff M. Acklin, of Toledo, Ohio, with a capital of $50,000, for the erection of a factory to make stamped metal articles.

A power plant, machine shop, foundry and woodworking plant are provided for in the plans for a new vocational high school, in Syracuse, N. Y. Henry C. Allen is city engineer.

Freeport Gas Machine Company, Freeport, Ill., of which Dr. D. C. Mease is president, has purchased a new factory site in Freeport and will erect a three-story factory building.

The Indianapolis (Ind.) Motor and Manufacturing Company has been incorporated with a capital of $300,000, by W. S. McDonald, J. Olias Vanier and G. R. Brown, of that city.

F. O. Motor Washer Company, Springfield, Ohio, has been organized to manufacture motor washers of all kinds. Incorporators, Wm. V. Frank, Chas. Oesterle, Herman Frank, etc. Capital, $15,000.

The Detroit (Mich.) Wheel Company has been formed with $1,000,000 capital to manufacture vehicles of all kinds. Chas. R. S.

Chisholm, A. W. Weir and F. A. Spitzer, of Detroit, are stockholders.

The American Carton Sealing Machine Company has moved from 1534 Johnson street to larger quarters at 120 South Sangamon street, Chicago, Ill., in order to take care of increased business.

The Vulcan Manufacturing Company, Fond du Lac, Wis., has been organized to engage in iron and steel-structural work. Capital, $30,000. Incorporators, Ulrich Anderson, Peter Halfman, Nick Halfman.

It is reported that the Pelton Water Wheel Company is in the market for equipment for its new eastern plant, at Harrisburg, Penn. J. B. Kunz, 90 West street, New York City, is eastern agent of the company.

The Front Drive Automobile Company, Jersey City, N. J., has been incorporated to manufacture automobiles, motor vehicles, etc. Capital, $50,000. Incorporators, J. F. Denison, F. E. Gollier, Herman Roth.

The Sandusky Foundry and Machine Company, Sandusky, Ohio, has bought from the receivers, the plant of the Warren Electric Manufacturing Company, and will operate it just as soon as the necessary changes can be made.

The American Railway Supply Company, a new concern, capitalized at $250,000, will erect a plant at Conneaut, Ohio, to manufacture parts used in the construction of locomotives. G. Tracy Fox, of Westfield, N. Y., is president.

The Superior Motor Garage Company, New York, has been organized with $10,000 capital to maintain garage, etc. Incorporators, Louis K. Schwartz, 311 West Ninety-seventh street; J. Robert Rubin, 150 West Fifty-seventh street.

Moline Pole and Shaft Company, Moline, Ill., J. B. Finley, president and manager, will increase the capacity of its shops by adding big warehouse and installing new machinery in some of the additional space that will thus be afforded in the present buildings.

Stover Engine Works, East Freeport, Ill., has begun improvements that will cost between $20,000 and $25,000. Two new buildings will be erected and the capacity of the foundry doubled. It is also planned to add materially to the machine shop. New machinery will be purchased.

Sioux City (Iowa) Foundry and Manufacturing Company has bought patent rights on Sioux City tractor and the capital of the company will be increased from $60,000 to $150,000 to permit of manufacture of the new tractor. The factory will be enlarged and new equipment installed.

The board of education, of Yonkers, N. Y., has named trustees George Bullock, R. G. Jackson and J. J. Fee, a committee to contract for machinery and other equipment for the Saunders Trade School, at a cost not to exceed $20,000. The building is now being erected. More equipment will be bought later.

The Western Brass Manufacturing Company, whose main plant is located at Campbell avenue and West Twenty-first street, Chicago, Ill., is erecting a new foundry at 2007-2011 Marshall boulevard, in order to take care of increasing business. The concern manufactures hardware and auto accessories in brass, bronze, etc.

SOUTHERN STATES

The Anderson Resilient Wheel Manufacturing Company, Nashville, Tenn., has been incorporated to manufacture wheels and parts for automobiles, also automobiles.

The Snyder Company, Knoxville, Tenn., has been organized to manufacture airbrake indicators. Capital, $50,000. Incorporators, O. A. Snyder, J. B. Jones, R. J. Yearwood, etc.

WEST OF THE MISSISSIPPI

W. M. Hoffert will erect a machine shop at Howard, S. D.

The Minnesota Screen Company will erect a factory at Chisholm, Minn.

John Westover & Co., of Lincoln, Neb., will erect a foundry and steel plant.

Mr. Neve, of Westby, N. D., will build an addition to his blacksmith shop.

Jacob Kramm, Portland, Ore., will build a commercial garage and repair shop.

The Harriman lines is building a roundhouse at Seattle, Wash. Cost, $50,000.

Thomas R. Palmer, Seattle, Wash., will build a commercial garage and repair shop.

Matheson Brothers, of Goldfield, Iowa, will erect a blacksmith and wagon shop this spring.

John Sinclair's blacksmith shop and general repair shop at Hannah, N. D., was burned.

Roy Wood, of Syracuse, Neb., will erect a factory for the manufacture of a patent gas machine.

W. E. Slaybough will put up a blacksmith shop at Velva, N. D. Mr. Slaybough is from Minot, N. D.

The Franklin Motor Car Company, San Francisco, Cal., has leased quarters for a new establishment.

Charles Duebel & Co., San Francisco, Cal., has taken out a permit to erect an addition to its metal-works plant.

G. H. Ross, Seattle, Wash., will build a commercial garage and repair shop. Modern equipment will be installed.

The Gorham Engineering Company, Oakland, Cal., has taken out a permit to erect a machine shop and boat-building plant.

The Lyle Corrugated Culvert Company, 2400 University avenue, southeast, Minneapolis, Minn., will erect additional buildings.

John A. Potter, Los Angeles, Cal., a former associate of Carnegie, is forming a company to start a large steel industry in this section.

Messrs. McMullen & McGinniss, Spokane, Wash., will build a commercial garage and repair shop. Modern equipment will be installed.

Robert A. Harris, Imperial Beach, near San Diego, Cal., will build a commercial garage and repair shop. Modern equipment will be installed.

The Regal Garage Company, Spokane, Wash., is building garages and repair shops at Pasco, Ellenburg, Walla Walla, Wenatchee and North Yakima. The plants will be fully equipped.

The Chehalis Foundry and Machine Company, Chehalis, Wash., has been purchased by T. H. Scheumann, Seattle, Wash. The plant will be improved, the capacity increased and new machinery installed.

The Western Motor Car Company, Los Angeles, Cal., has purchased property on Hope street for $90,000, and will erect a large commercial garage. Modern repair machinery, etc., will be installed.

The Western Machinery and Foundry Company, Santa Barbara, Cal., will soon commence the erection of extensive additions to its plant. A new foundry and large garage will be built. Both will be fully equipped.

The city of Santa Monica, Cal., is planning to build a polytechnic high school. One building will be devoted to a machine-shop and woodworking department. Modern equipment will be installed; about $160,000 will be expended.

The Corvallis Agricultural College, Corvallis, Ore., during 1911, will build a farm mechanic's building to cost $14,000, and a foundry building to cost $11,000, a mining building to cost $28,000 will also be erected. The State has made these appropriations.

The manual-arts building of the new polytechnic high school at Riverside, Cal., will be thoroughly equipped with forge equipment, machine shop and woodworking machinery and kindred apparatus. Bids will soon be asked. N. F. Marsh, architect, Los Angeles.

The Agutter-Griswold Company, Seattle, Wash., manufacturing electrical specialties, has had plans prepared for a new factory building. Machinery will be required for punching and forming; a sheet-metal department is included. All machinery will be motor driven.

CANADA

The Canada Metal Company, of Toronto, is building a big addition to the factory.

C. Manuel, of Montreal, will build a large automobile plant at Lachine, Quebec.

The Western Wire and Nail Company, of London, Canada, will build a new $250,000 plant.

The Dominion Iron and Steel Company, of Sydney, N. S., is making important extensions to its plant.

The Oliver Chilled Plow Company will shortly let the contract for another addition to its plant at Hamilton, Ont., to be used as a machine shop.

Vickers' Sons & Maxim, of Sheffield, Eng., will erect a large plant at Winnipeg. The company manufactures guns, castings, small tools, electric motors, etc.

GENERAL MANUFACTURING

NEW ENGLAND

Winsted, Conn., will install a sewer system.

Marion, Mass., will build a new pumping station.

Methuen, Mass., is in the market for a stone crusher.

Putnam, Conn., is in the market for a stone crusher.

Rockland, Mass., will build a municipal electric-light plant.

The Grant Yarn Mill, Fitchburg, Mass., is to erect an addition.

Wolfboro, N. H., will make improvements in the water system.

Tyngsboro, Mass., is contemplating installing a new water system.

The N. H. Artistic Web Company, Barnstead, N. H., will install a boiler.

The American Woolen Mill Company will build another mill at Enfield, N. H.

The city of Chelsea, Mass., will install steam boiler in the Williams school.

The Adams Paper Company, of Wells River, Vt., will build an addition to its mills.

Northampton, Mass., contemplates installing a municipal electric-lighting plant.

The Winchendon (Mass.) Electric Light and Power Company will double its capacity.

The Dun Worsted Mills will build an addition to its plant at Woonsocket, R. I.

The Massachusetts Land Brick Company, West Oxford, Mass., will install a boiler.

Brockton, Mass., contemplates the installation of a municipal electric-lighting plant.

South Framingham, Mass., is considering installing a municipal electric-lighting plant.

The Lebanon (N. H.) Electric Light Company contemplates installing a new engine.

The Baird Machine Company, Bridgeport, Conn., is considering installing an oil engine.

The Amoskeag Mills, Manchester, N. H., will install a 5000-kilowatt turbine generator set.

The Morley Button Manufacturing Company, Portsmouth, N. H., will enlarge its plant.

The Lowes laundry, South Norwalk, Conn., is contemplating installing a 60-horsepower boiler.

The Lovell & Covel Company, Boston, Mass., is in the market for a 50-horsepower engine.

The Salts Textile Manufacturing Company, Bridgeport, Conn., will install four new boilers.

The Preston Fertilizer Company, Laurel Hill, R. I., will install boiler, engine and pumps.

The Adams Paper Company, Wells River, Vt., will erect a dam and an addition to its paper mill.

The United Electric Light Company, Springfield, Mass., will make extensive improvements.

The Beverly (Mass.) Gas and Electric Company will install generator set, boilers and accessories.

The American Buildings Trust Company, H. L. Gilman, Boston, Mass., will install boilers and pumps.

The plant of Emerson & Norris, artificial stone manufacturers, Brighton, Mass., was badly damaged by fire.

The Wm. Carter Company, Needham Heights, Mass., manufacturing underwear, is erecting a two-story addition.

Brockton, Mass., will build two reservoirs, 4,000,000 gallons capacity each; pumps and engines will be installed.

The Rutland (Vt.) Railway, Light and Power Company is building up the Carvers Falls plant, at Whitehall, Vt.

Fire practically destroyed the player-piano department of the Sterling Piano Company, Derby, Conn. Loss, $50,000.

Doane & Williams, carpenters and builders, Holyoke, Mass., will move to Willimansett. A three-story mill will be erected.

The White-Warner Stone Company, Taunton, Mass., will erect a new factory into which it will move when completed.

The Connecticut Valley Street Railway, Greenfield, Mass., is in the market for a 500-kilowatt rotary for its power house.

The Graton & Knight Manufacturing Company, Worcester, Mass., tanners and leather-belting makers, will erect a two-story addition.

The Sea View Railroad is to make extensive improvements to its power plant at Hamilton, R. I. It includes a 500-horsepower boiler.

The Naugatuck (Conn.) Chemical Company, owned by the United States Rubber Company is to reorganize and plans an extension of its business.

Lee Brothers & Co., Athol, Mass., shoe manufacturers, will change from steam to electric power. Will install two turbines of about 100 horsepower each.

The Margolius Manufacturing Corporation, Fall River, Mass., has been chartered to manufacture bagging. Incorporators, L. B. Way, president; P. W. Kear, vice-president, and L. P. Mathews, secretary.

The Hartford (Conn.) Carbon Company has been incorporated with a capital of $300,000 to manufacture carbon and similar products. Incorporators are F. L. Palmer and A. F. Lyon, of Hartford; also E. A. Taylor, of Plainville, Conn.

The slate mill of the Fair Haven Marble and Marbleized Slate Company, at Fair Haven, Vt., was burned, entailing a loss of about $25,000. Much valuable machinery for polishing and cutting slate was destroyed. The concern will probably lease another building to conduct its business.

MIDDLE STATES

Moore Brothers will erect a candy factory at Oil City, Penn.

Albert Lapinski, of Wausau, Wis., will erect a cigar-box factory.

The city power plant at Jefferson, Wis., was destroyed by fire.

The Scranton (Penn.) Lace Company will erect a four-story addition.

The Troy (N. Y.) Waste Manufacturing Company will erect an addition.

The Chester (Penn.) Milling Company's plant was burned. Loss, $100,000.

The Shaughnessy Knitting Company, Watertford, N. Y., will erect an addition.

Plans are being prepared for a new waterworks system for Niagara Falls, N. Y.

The H. M. Curtis Company will erect a furniture factory at Jamestown, N. Y.

Fire destroyed cold-storage and ice plant of Conover Gaskin, Long Branch, N. J.

Fire destroyed the Thos. H. Hayes welting factory at Belvidere, N. J. Loss, $10,000.

The Ontario Button Company, of Amsterdam, N. Y., will remove its plant to Utica.

The Twin City Auto Tire Company, of Marinnette, Wis., will build a two-story plant.

The Ross Rubber Works, at Mineral Point, Wis., was destroyed by fire. Loss, $25,000.

Martin Denis Company will erect a large chemical-manufacturing plant at Newark, N. J.

The city of Ashtabula, Ohio, will soon double the capacity of its electric-light plant.

Definite preparations have been made to build an electric-lighting plant at Pendleton, Ind.

Fire destroyed the factory of the Blum Shoe Manufacturing Company, Dansville, N. Y.

The United Cigar Manufacturers Company, Perth Amboy, N. J., will erect a factory addition.

The plant of the Minnesota Billiard Table Company, at Milwaukee, Wis., was destroyed by fire.

The McClay Glass Company, Mount Jewett, Penn., will erect a new glass plant near Bristol.

John Hohenadel, of Philadelphia, is going to have a two-story addition built to his brewery.

The plant of the Cyphers Incubator Company, Buffalo, N. Y., was burned. Loss, $75,000.

Fire did $50,000 damage to the plant of the Monarch Refrigerating Company, Chicago, Ill.

The plant of the Hilty Lumber Company, Milwaukee, Wis., was burned. Loss, about $150,000.

Ransbottom Brothers, Roseville, Ohio, will build additions to their pottery to cost $125,000.

A coal-handling derrick of the Milwaukee Western Fuel Company was blown up with dynamite.

The W. H. Newborn Glass Works, of Royersford, Penn., was destroyed by fire. Loss, $125,000.

The DeVilbiss Manufacturing Company, Toledo, Ohio, is in the market for exhaust equipment.

The Continental Sugar Company will erect a $750,000 plant at West Park, a suburb of Findlay, Ohio.

The United Food Products Company, of Chicago, Ill., will erect a six-story building on Erie street.

The Jermyn Cut Glass Company, of Scranton, Penn., is locating a branch factory at Carlisle, Penn.

The Wellknit Hosiery Company, Harrisburg, Penn., will erect a new three-story mill, it is said.

Fire totally destroyed the handle factory and sawmill of Samuel Houser, at Upper Sandusky, Ohio.

The Two Rivers Company will put up a three-story addition for its tub factory at Two Rivers, Wis.

G. W. Garrett & Sons, Philadelphia, Penn., wagon builders, will erect an additional manufacturing building.

The Wm. Dunbar Company, Cleveland, Ohio, will erect a new large concrete planing mill for wood work.

A six-story factory will be erected for the Curtis & Jones Company, Reading, Penn., manufacturing shoes.

John and Burt Marples, Milton, Ind., will open an ice plant at that place and install ice-making machinery.

The Washburn-Crosby Milling Company, 54 Michigan street, Buffalo, N. Y., will build an addition to its plant.

The plant of the Washington (Ill.) Electric Light and Power Company was destroyed by fire. Loss, $50,000.

The umbrella-tube factory of Kellar & Lowney, Philadelphia, Penn., was destroyed by fire. Loss, $35,000.

The plant of the Monarch Cold Storage Company, 40 East Michigan street, Chicago, Ill., was destroyed by fire.

The Natalie Breaker, owned by the Colonial Coal Company, Shamokin, Penn., was destroyed by fire. Loss, $35,000.

The Sheboygan (Wis.) Box Company will erect a plant at Sturgeon Bay, Wis., to manufacture berry boxes and crates.

Fire destroyed the thread mill of the R. J. Ederer Thread Company, at Unity and Elizabeth streets, Philadelphia, Penn.

Carr & Brown, Hamilton, Ohio, are rebuilding their flour mill, recently destroyed by fire. New equipment will be required.

The Bavarian Brewing Company, Toledo, Ohio, has taken out a building permit for the erection of a bottling factory.

The State of Delaware has appropriated the sum of $40,000 for a new electric-lighting plant to be built at Clayton, Del.

F. S. Lodge, carriage manufacturer, is having a three-story addition built at 113-115 Rittenhouse street, Philadelphia, Penn.

Hummel & Downing are erecting a $350,000 paper mill and folding-box factory at Cambridge and Thomas streets, Milwaukee, Wis.

P. T. Finnigan, of Wausaukee, Wis., is planning to build a large sawmill and lay out a new lumbering village, at Davis Spur, Wis.

The Wm. Edwards Company, Cleveland, Ohio, will require two 150-kilowatt and one 75-kilowatt generators for new warehouse.

The city of Stoughton, Wis., will buy the water and electric plant of the Stoughton Mill Company and make extensive improvements.

The Cleveland Macaroni Company, Cleveland, Ohio, has increased its capital stock from $100,000 to $200,000. Will add new equipment.

Philip Semler, High and Water streets, Hamilton, Ohio, will establish an uptodate laundry. New and modern equipment will be installed.

The substation of the Newburgh (N. Y.) and the Poughkeepsie Light, Heat and Power Companies, at Highland, N. Y., was burned. Loss, $10,000.

The New York & Long Island Traction

Company, Hempstead, N. Y., is in the market for a 750-kilowatt rotary converter and three transformers.

A company to be known as the Williams Food Products Company, at Paoli, Ind., has been organized to can and preserve fruits and vegetables.

The capital stock of the Marion Water Company, of Marion, Ohio, has been increased to $700,000 to permit of additions and extensions.

The Elbel Cigar Box Manufacturing Company, Evansville, Ind., has been incorporated with a capital of $15,000 by H. F. Frederick and Louis Elbel.

The Coshocton Art Leather Company, Coshocton, Ohio, has been incorporated for $10,000 by R. M. Temple, etc., to manufacture art leather work.

E. Fellabaum has taken out a building permit for the erection of a factory building at 1124 True street, Toledo, Ohio, for the manufacture of cement blocks.

The Bell Telephone Company will build a new exchange on the property recently acquired at the corner of Broadway and Greenwood streets, Toledo, Ohio.

The property of the Vulcan Brick Company, at Athens, N. Y., has been sold to Nathan Gladselter, of White Plains, N. Y., who will reopen it next spring.

The Atlantic Refining Company, of Philadelphia, Penn., is building an addition to its oil-refining plant at Thirtieth and Schuylkill avenues, Philadelphia, Penn.

The Acme Building and Supply Company, corner of Front and Droege streets, Toledo, Ohio, is making improvements in order to give room for further extensions.

The Wisconsin Pea Canners Association, of Manitowoc, Wis., will open a plant at Cumberland, Barron county, with a daily capacity of 60,000 cans, and one at Amery.

Fire completely destroyed the plant of the Claykraft Brick Company, at Groveport, Ohio, recently. The loss is estimated at $30,000. The plant will probably be rebuilt.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids April 11, for two electric hoists (schedule No. 3435), one band saw (schedule No. 3437).

Osborne Manufacturing Company, Cleveland, Ohio, making brushes, brooms and foundry supplies, has increased its capital to $200,000. New equipment will be installed.

Plans for a $250,000 umbrella factory for the S. S. Fretz syndicate, at Philadelphia, Penn., are being prepared. Site has been bought at 4 Sedgeley avenue and Twenty-second street.

The Reyburn Manufacturing Company, of Philadelphia, Penn., manufacturers of paper tags, etc., will build an addition to its plant at Twenty-third street and Allegheny avenue, Philadelphia, Penn.

The Miami Power Company, recently organized, will build a $500,000 hydroelectrical power plant to furnish current to Hamilton, Middletown, Miamisburg and Franklin, at Woodsdale, Ohio, on the site of the old paper mill.

The France Brothers Company, Toledo, Ohio, has been organized with a capital of $50,000 to quarry all kinds of stone and manufacture stone products, by Thos. A. Gifford, Valeria Stuckey, Alta H. Caldwell, etc.

The Limestone Products Company is the name of a large corporation which will be organized to engage on a broad scale in the production of limestone and kindred products in the limestone formations northwest of Columbus, Ohio. John Stone, of Marion, Ohio, will be general manager.

SOUTHERN STATES

Packing plant of Christopher F. Kurrie, Baltimore, Md., was destroyed by fire.

Fire destroyed the plant of the Chester (S. C.) Machine and Lumber Company. Will be rebuilt.

The Gandy Belting Company, Baltimore, Md., will erect a five-story addition to its plant on Lemmon street, near Fremont avenue.

WEST OF THE MISSISSIPPI

C. N. Monk, of Vilborg, S. D., will erect a planing mill.

The Lake View (Iowa) Creamery was destroyed by fire.

F. C. Billings, of West Union, Iowa, will erect a creamery.

Chappell, Neb., will issue bonds for an electric-light plant.

Douglas, Ariz., is considering the erection of an electric power plant.

H. G. Higgins and J. C. Poole, of Baldwin, N. D., will erect a creamery.

Louis Talk, of Pettibone, N. D., is planning the erection of a creamery.

The Kenmare (N. D.) Bottling Works, destroyed by fire, will be rebuilt.

Wilcox, Ariz., is contemplating the erection of an electric power plant.

The Brooklyn (Iowa) Lumber and Grain Company will erect a creamery.

The city of Astoria, Ore., will make improvements in its water system.

The pop-corn factory of C. W. Daly, Los Angeles, Cal., was destroyed by fire.

The Des Moines (Iowa) Silo Company will locate a branch plant in Wichita, Kan.

The city of Gresham, Ore., will install a new waterworks and sewerage system.

The city of Exeter, Cal., is contemplating the installation of a new sewer system.

The Tracy (Minn.) Coöperative Creamery Company will erect a modern creamery.

The Virginia Brewing Company will erect a cold-storage plant at Chisholm, Minn.

The city of Pasco, Wash., is contemplating the installation of a waterworks system.

G. M. Partridge, Falls City, Ore., is planning to build a brick-manufacturing plant.

The Bartlett Heard ranch, near Phœnix, Ariz., will install a new pumping plant.

The city of Baker City, Ore., is planning to make improvements in its sewer system.

The Yuncker Bottling Works, Tacoma, Wash., will make improvements in its plant.

J. George Smith, candy manufacturer, St. Paul, Minn., will erect a new $10,000 factory.

Fire destroyed planing mill of J. F. Ball & Brothers, Pollock, La. Loss, $75,000.

The Golden Reward Consolidated Mining Company will erect a sawmill at Deadwood S. D.

The Phœnix Railway Company, Phœnix, Ariz., will build a new substation at Orangewood.

The Chino Domestic Water Company, Chino, Cal., will rebuild its present water system.

W. D. Fenton, Portland, Ore., will rebuild his printing establishment, recently destroyed by fire.

A. J. West's Lumber Company, at Junction City, Wash., was destroyed by fire. Loss, $100,000.

Frank Blankenship, San Jacinto, Cal., will install a pumping plant on his property in this section.

J. Isaacson, of Rugby, N. D., is planning the erection of a sash and door factory at Havre, Mont.

The Central Creamery Company, Ferndale, Cal., is building a dry-milk plant to cost about $60,000.

Robinson & Moses, of Belle Fourche, S. D., will erect a factory for the manufacture of cement blocks.

G. Menge, secretary of the Oak Valley Creamery Company, will erect a creamery at Wadena, Minn.

Benjamin Cunha, Half Moon Bay, Cal., is planning to install an electric-lighting plant in this section.

F. L. Botsford, Portland, Ore., has purchased timber property, near Sandy, and will build a sawmill.

The city of Pendleton, Ore., is contemplating the installation of a waterworks system to cost $200,000.

The Goldendale Dressed Meat Company, Goldendale, Wash., is planning to build a new packing plant.

H. E. Wharton, of Malta, Mont., has petitioned the council for a franchise for an electric-light plant.

The Northwestern Glass Company, Minneapolis, Minn., is considering plans for a new four-story building.

A. N. C. Treadgold, Dawson, Alaska, will build a power plant on the Klondike river in the spring, 1911.

The Schuler Chocolate Company, of Winona, Minn., will remodel a large building there for a factory.

The Commercial Club, Boise, Idaho, is interested in a project to establish a woolen mill in this section.

The Kennewick Packing Company, Kennewick, Wash., is planning for the erection of a new packing plant.

The Salem Brewing Company, Salem, Ore., has taken out a permit to erect a new plant to cost about $40,000.

The Home Telephone Company, Los Angeles, Cal., is planning to install a plant and system at Chico.

The Opportunity Box Manufacturing Company, Opportunity, Wash., will double the capacity of its plant.

W. W. Brison, San Bernardino, Cal., will double the capacity of his ice and electric plants at Barstow, Cal.

The East Side macaroni factory, Los Angeles, Cal., has taken out a permit to build an addition to its plant.

The lumber mill of the A. J. West Lumber Company, Aberdeen, Wash., recently destroyed by fire, will be rebuilt.

The Burroughs-White Trunk Company, Los Angeles, Cal., is having plans prepared for a new factory building.

The city of Baker City, Ore., is planning to install a municipal electric-lighting plant. Plans are being prepared.

"The Perris Progress," Perris, Cal., is planning to erect a new printing plant. New machinery will be installed.

The Escondido Utility Company, Escondido, Cal., will make improvements and extensions in its street-lighting system.

The Pacific Tank and Pipe Company, San Francisco, Cal., has taken out a permit to build an addition to its plant.

The Portland Railway, Light and Power Company is planning to erect an emergency building on East Water street.

The Maple Lumber Company's planing mill,

at Bryn Mawr, Wash., was destroyed by fire. Loss, $25,000. Will be rebuilt.

A vote will be taken on granting a franchise to Jos. Hutchinson, at Manchester, Iowa, to install an electric-light plant.

The Balfour-Guthrie Company, Portland, Ore., has taken out a permit to erect a boiler-room addition to its plant.

The Jackson-Eno Rubber Company, Los Angeles, Cal., has taken out a permit for an engine-room addition to its plant.

John Snyder, the Tacoma Fir Door Company, Tacoma, Wash., is planning to build a sawmill of 50,000 feet daily capacity.

The David's sawmill, Point Terrace, near Eugene, Ore., is increasing the capacity of its plant. New machinery will be installed.

The plant of the Scott River Dredging Company, Callahan, Cal., supplying power in this section, was destroyed by fire. Loss, $75,000.

The California Cotton Mills Company, San Francisco, and Oakland, Cal., is planning to build a cotton-fabric factory at San Diego, Cal.

Reynolds & Elliott, Miles, Wash., are planning to erect a sawmill on the Spokane river. The plant will have a capacity of 30,000 feet daily.

The Doernbecher Manufacturing Company, Portland, Ore., has commenced the erection of additional buildings to be used as a chair factory.

The Guaranty Pipe Line Company, Los Angeles, Cal., operating in the Midway district, Cal., will install new boilers and pumping equipment.

The Old Castle Rock mine, near Castle Rock, Wash., will build a plant for the manufacture of briquets. About $60,000 will be expended.

The Whittier State School, Whittier, Cal., will soon be in the market for boiler equipment. A bill has passed the legislature for this purpose.

The Mesa Dairy Company, Mesa, Ariz., will build a new ice-manufacturing plant. Arnold Brothers, Phœnix, have the contract for building erection.

The Mobridge (S. D.) Electric Light, Power and Heat Company has been granted a franchise to install a heat-distributing and electric-light plant.

The Holtville Creamery Company has been organized at Holtville, Cal. The company will immediately build a creamery plant. It will be fully equipped.

The Anchor Plastic Stone Company, Los Angeles, Cal., manufacturing composition drainboards, floors, etc., will increase the capacity of its factory.

The plant of the Lystul Stuvland Lumber Company, Lystul, near Glendale, Ore., comprising saw and planing mills, was destroyed by fire. Loss, $20,000.

C. D. Holley, Tulare, Cal., at the head of the Holley Electric Company, Porterville, will erect a steam auxiliary power plant at Tulare in the near future.

R. S. Johnson, Vale, Ore., has been granted a telephone franchise in this city. A company will immediately be organized and a complete system installed.

The Elite Laundry Company, El Paso, Texas, is having plans prepared for a new laundry plant. It will be fully equipped with necessary machinery.

The California Shoe Manufacturing Company has been incorporated at Los Angeles, Cal., by E. W. Davies and F. R. Harris, with a capital stock of $100,000.

The L. M. Rice Company, Portland, Ore., is at the head of an irrigation project in the Horse Haven district. About $12,000,000 will be expended in this work.

The Union Lithograph Company, Los Angeles, Cal., has had plans prepared for a new plant to be erected on East Seventh street. About $40,000 will be expended.

J. F. McIndoe, engineer, Kelso, Wash., is in charge of extensive irrigation work, which is planned for the Cowlitz river district. About $30,000 is to be expended.

Power-plant equipment will be required in the new office building to be erected by the Healy Investment Company, Portland, Ore. About $150,000 will be expended.

The machinery of the oil-pumping plant of the Chicago, Milwaukee & Puget Sound Railroad, at Othello, Wash., was damaged by fire. The building was destroyed.

The California Alfalfa Meal and Milling Company, Los Angeles, Cal., is planning to build a modern milling plant at Riverside, Cal. About $25,000 will be expended.

The county and city of Riverside, Cal., are contemplating the establishment of a rock quarry in this vicinity. A rock-crushing plant will be installed for joint use.

The Tempe Canal Company, Tempe, Ariz., is planning for extensive irrigation work in this vicinity. About $44,000 will be expended. Pumping plants will be installed.

The Kern Mutual Telephone Company, allied with the Pacific Telephone and Telegraph Company, Bakersfield, Cal., is planning to erect a new exchange building at Taft, Cal.

Seth Hartley, Escondido, Cal., is planning to install an irrigation system on the Bernardo ranch of several thousand acres in this section. A pumping plant will be installed.

Power-plant equipment will be required in the new 12-story office building to be erected at Seattle, Wash., by the Walker-Talbot Company. About $1,000,000 is estimated cost.

W. A. Harrison and U. S. Agnew, White Bluffs, Wash., are at the head of a project for extensive irrigation work in this section. New pumping equipment will be required.

The Rio Honda Water Users' Association, Roswell, New Mexico, is planning for extensive irrigation work in this section; pumping plants will be built. About $60,000 will be expended.

The American Gypsum Company, New York, with an agency at Los Angeles, Cal., is planning to erect a plant for the manufacture of gypsum products near Blythe station, Ariz.

The Chuckawalla Water Company, Blythe, near Daggett, Cal., is planning for extensive irrigation work in the Palo Verde valley. A power plant will be erected and pumping plants installed.

J. W. Forgeus, San Francisco, Cal., has purchased the power plant, rolling stock, etc., of the Watsonville Transportation Company, Watsonville, Cal. Many improvements in the property will be made.

The Alaska Water, Light and Telephone Company, Valdez, Alaska, is planning to make extensive improvements in its plant in the near future. A higher voltage in transmission lines will be carried.

The board of supervisors, Los Angeles, Cal., will receive bids up to April 17, for furnishing and installing two engine-generator sets in the Hall of Records. Plans by Hudson & Munsell, architects, Los Angeles.

Mechanical drawing rooms, a vacuum-cleaning plant, ventilating system, etc., will be installed in the new high school to be erected at Salt Lake City, Utah. Estimated cost, $500,000. Geo. W. Eldredge, architect, Salt Lake.

G. H. Tully and H. B. Lind, Sacramento, Cal., are planning to organize a company known as the Central California Hydroelectric Power Company. The company will build a power plant on the Feather river in Butte county.

Power-plant equipment will be required in the new hospital building contemplated by the Woman's Hospital Association, Los Angeles, Cal. This company has been recently incorporated for $250,000 by M. R. Bruin and R. C. Dundas.

The Coachella Valley Ice and Electric Company has been incorporated with a capital of $300,000, by W. F. Holt. The headquarters of the company will be at Redlands, Cal. The company owns large property in the Imperial valley and is planning to operate extensively.

W. F. Holt, Redlands, Cal., is at the head of an enterprise which has purchased 100,000 acres in the Palo Verde valley, near Yuma, Ariz. The property will be placed under irrigation; extensive work is planned, pumping plants will be installed. The company will expend about $3,000,000.

The legislature at Pendleton, Ore., has passed a bill for the following appropriations for a state insane asylum; $25,000 for power plant for lighting; $30,000 for waterworks and sewerage system; $25,000 for automatic sprinkler system; $50,000 for heating plant and equipment. State architect, Portland.

John W. Sharpe, Los Angeles, Cal., has purchased 5000 acres in the Little Simi valley, and is planning the installation of extensive irrigation works; pumping plants will be installed. About $75,000 will be expended. A plant is contemplated for the manufacture of concrete pipe for this work.

CANADA

Saskatoon, Sask., will install a mechanical water-filtration plant.

Saskatoon, Sask., will equip an electric street-railway system.

The Watson Carriage Company's plant, at Ottawa, will be greatly enlarged.

Scotstown, Que., will install a complete new waterworks pumping system.

The C. Turnbull Knitting Company, Galt, Ont., will erect a four-story addition.

The Port Arthur Enamel Works is building a big factory at Port Arthur, Ont.

The Atlantic Sugar Company is building a $2,000,000 refinery at St. John, N. B.

Welland, Ont., will buy turbine engines and complete equipment for new waterworks.

Ramsay & Son will erect a new paint factory on St. Pauls street, Montreal, Que.

The city of Melville, Saskatchewan, will install a complete new waterworks system.

Battleford, Sask., will spend $100,000 for waterworks, pumping and other machinery.

The Ottawa (Ont.) Electric Railway Company will build an addition to its power house.

The Independent Glass Producers, Ltd., Toronto, Ont., will build a new factory to cost $20,000.

The Canadian Stewart Company will erect a $2,000,000 pulp and paper mill at Jonquiere, Que.

The Y. M. C. A., Montreal, Canada, will erect a new power house next to its new building to cost $15,500.

The plant of the Red Deer Lumber Company, at Barrows, Sask., Canada, was destroyed by fire. Loss, $100,000.

The Mount McKay and Kakabeka Falls Railway Company, of Fort William, Ont., will make important extensions requiring more equipment and machinery.

CENTRAL AMERICA

The Honduras Consolidated Gold Mining Company, operating in the Quiebra Grande district, Honduras, will, it is stated, build a large hydroelectric plant.

MINING

The Palomas mine, Sonora, Mexico, will install a new concentrating plant.

The Guerrero mine, Guerrero, Mexico, will increase the capacity of its stamp mill.

The Golden Arrow mine, near Tonopah, Nev., is planning to install a 10-stamp mill.

The Oro Belle mine, near Hart, Nev., is contemplating the erection of a 10-stamp mill.

The Los Tajos mine, Santiago district, Sinaloa, Mexico, will install a cyanide plant.

The Phœnix mine, Randsburg district, Cal., will make improvements in its stamp mill.

The Jamison mine, Plumas county, Cal., is contemplating the erection of a new stamp mill.

White Smith, Bishop, Cal., is planning to install an electric tramway system at his mine.

The Palor Quemados mine, near Cumuripa, Sonora, Mex., will install a new cyanide plant.

The Nelson Mining Company, Crown King district, near Prescott, Ariz., will install new machinery.

The Rainbow mine, Mormon Basin district, Oregon, will install a cyanide plant in the near future.

The El Carmen Copper Company, operating at Durango, Mexico, is planning to install a new mill.

The Maravillas Mining Company, Hidalgo, Mexico, is planning to increase the capacity of its plant.

The Fresnillo Mining Company, operating in Zacatecas, Mexico, is planning to erect a cyanide plant

G. B. Hyde, operating on the Van Duser properties, near Mina, Nev., will build a new milling plant.

The Brooklyn-Arizona Mining Company, operating near Mayer, Ariz., will build a smelting plant.

The Jerome-Durango Gold Mining Company, operating near Jerome, Ariz., will install a five-stamp mill.

The Mexican Mines Company, operating the La Bonita property, Guanajuato, is planning to erect a mill.

The Eldora Oil Company, Maricopa field, near Bakersfield, Cal., will install new rotary drill equipment.

The Silver Legion mine, Nob Hill, near Searchlight, Nev., will install new machinery in the near future.

The Midas mine, neah Randolph Flats, Grass Valley district, Cal., is planning to install new equipment.

W. D. Egilbert, operating on Clear creek, Redding district, Cal., is planning to build a new dredge in 1911.

The Deep Gravel mines, Waldo, Ore., will install new dredging plants in 1911. They will be fully equipped.

The Gold Hill mine, near Quartzburg, Boise county, Idaho, is planning to increase the capacity of its mill.

The Mexican Mining and Development Company, operating in Oaxaca, Mex., is planning to install new machinery.

The Burlington mine, Forbestown, Butte county, Cal., is planning for the erection of a 100-ton reduction plant.

The Monarch Mining and Smelting Company, operating near Wickenburg, Ariz., will build a new smelting plant.

The New York-Searchlight mine, near Searchlight, Nev., will install new hoisting equipment in the near future.

The Wisconsin Mining and Milling Company, Jicarillas, New Mexico, will install new crushing machinery in its mill.

The Tominal mines, near Torreon, Coahuila, Mexico, is remodeling its cyanide plant. New equipment will be installed.

The Buckhorn mine, in the Buckhorn district, Lauder county, Nev., owned by George Wingfield, will build a new mill.

The Samson Mining Company, on Eagle creek, near Wallace, Idaho, will install new machinery and hoisting equipment.

The Old Channel Company, operating in the Galice district, Oregon, is planning to install new dredging machinery in 1911.

The El Triunfo mines, near Cananea, Sonora, Mexico, is building a concentrating plant; other improvements will be made.

The Chino Copper Company, Santa Rita, New Mexico, will double the capacity of its reduction plant, now 3000 tons, by 1912.

The Utah Smelting Company, Salt Lake City, Utah, is planning to install a number of small smelting plants at its various properties.

The Copa de Oro Mining and Milling Company, operating the Blue Bell mine, near Glencoe, Cal., is contemplating the erection of a mill.

The Los Angeles Copperfield Mining Company, operating in the Whipple mountains, near the Wyatt Earp property, Ariz., will install new machinery.

The Portland Canal Mining Company, operating in the Portland Canal district, British Columbia, will increase the capacity of its concentrating plant.

The Hermosa Consolidated Mining and Reduction Company, operating at Hermosa, N. M., is planning to erect a 200-ton concentrating and cyanide plant.

The Pulaski Coal and Navigation Company, Coquille, Ore., has purchased new coal property and is planning for extensive work. New equipment will be installed.

The West Coast Smelting and Refining Company, operating the Tecolote property, near Carbo, Sonora, Mexico, will build a 1000-ton concentrating plant and a smelter.

Andrew Laidlaw, Spokane, Wash., has purchased coal property in the Crow's Nest Pass district, British Columbia, and is planning for extensive work. New machinery will be installed and the property fully equipped.

BUSINESS ITEMS

The New England sales office of the Link-Belt Company, formerly located at 84 State street, Boston, Mass., has been moved to 131 State street, Boston. Lawrence Spillan is in charge.

The Fasnir Bearing Company, New Britain, Conn., has been incorporated under the laws of Connecticut, with a capital of $100,000, and will manufacture a full line of ball bearings for all purposes, in strict accordance with the best European practice. The officers of the new company are H. S. Hart, president; E. C. Goodwin, vice-president, and E. H. Cooper, secretary and treasurer. These will constitute the board of directors, together with E. A. Moore, second vice-president of the Stanley Works; F. G. Vibberts, treasurer of the New Britain Trust Company; J. E. Cooper, corporation counsel of New Britain. Mr. Hart is also president of the Hart & Cooley Company; Mr. Goodwin is the superintendent of the same company, and E. H. Cooper, who is the active manager of the new company, was formerly secretary and manager of the E. E. Hilliard Company, Buckland, Conn. The sales agents are the Rhineland Machine Works Company, 140 West Forty-second street, New York city.

TRADE CATALOGS

The Bayonne Casting Company, Bayonne, N. J. Catalog. Monel metal. Thirty pages, 4x7 inches.

Independent Pneumatic Tool Company, Chicago, Ill. Circular N. Thor air tools and appliances. Illustrated.

Tate, Jones & Co., Pittsburg, Penn. Circular No. 134. Portable fuel oil burner, compressed air type. Illustrated.

Little Giant Punch and Shear Company, Sparta, Ill. Circular. Little Giant hand punch and shear. Illustrated.

J. W. Paxson Company, Philadelphia, Penn. Bulletin No. 21. Wheelbarrows and trucks. Illustrated, 20 pages, 6x9 inches.

Chicago Machine Tool Company, Chicago, Ill. Catalog. Small milling machines. Illustrated, 70 pages, 4x6 inches, paper.

Adell Brothers Manufacturing Company, Orange, Mass. Circular. "Paramount" indestructible pressed-steel clamp. Illustrated.

T. R. Almond Manufacturing Company, Ashburnham, Mass. Catalog. Almond tool holder. Illustrated, 24 pages, 5x7½ inches.

The Jacobs Manufacturing Company, Hartford, Conn. Catalog. Jacobs improved drill chuck. Illustrated; 34 pages, 6x9 inches, paper.

The Carlyle-Johnson Machine Company, Manchester, Conn. Catalog E. Friction clutches. Illustrated, 36 pages, 4½x7 inches, paper.

Gardner Machine Company, Beloit, Wis. Catalog. Disk-grinding machinery and accessories. Illustrated, 128 pages, 6x9 inches, paper.

Smooth-On Manufacturing Company, Jersey City, N. J. Pamphlet. Extracts from Smooth-On Instruction Book. Illustrated, 16 pages, 3½x6 inches.

The Industrial Instrument Company, Foxboro, Mass. Bulletin No. 40. Dr. Horn tachometers and tachographs. Illustrated, 36 pages, 8x11 inches.

The Borden Company, Warren, Ohio. Pamphlet No. 11. Beaver die stocks, Beaverette and Warren die stocks. Folder No. 12. Ohio die stocks. Illustrated.

Fort Wayne Electric Works, Fort Wayne, Ind. Bulletin No. 1126. Electric fans. Illustrated, 26 pages, 8x10½ inches. Bulletin No. 1122. Small motors and their applications. Illustrated, 11 pages, 8x10½ inches.

Thos. H. Dallett Company, Philadelphia, Penn. Bulletins Nos. 200, 201, 202. Air compressors. General construction details. Straight-line belt-driven and steam-driven machines. Illustrated.

Edgar T. Ward & Sons, 25 Purchase street, Boston, Mass. Catalog and Price-List "H." Capital high-speed and Dannemora tool steels, cold-rolled strips, bars, wire, seamless tubing, twist drills, taps, gear and milling cutters, etc. Illustrated, 128 pages, 5x8 inches, paper.

FORTHCOMING MEETINGS

American Supply and Machinery Manufacturers' Association, National Supply and Machinery Dealers' Association and Southern Supply and Machinery Dealers' Association; joint annual convention, Hotel Seelbach, Louisville, Ky., April 3-5, 1911. F. D. Mitchell, secretary, 309 Broadway, New York City.

National Metal Trades Association, thirteenth annual convention, April 12-13, Hotel Astor, New York City. Robert Wuest, commissioner, New England building, Cleveland, Ohio.

National Machine Tool Builders' Association, spring meeting, May 18-19, 1911, Hotel Marlborough-Blenheim, Atlantic City. Chas. E. Hildreth, secretary, Worcester, Mass.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers, spring meeting, Pittsburg, Penn., May 30 to June 2, 1911. Secretary, C. W. Rice, 29 West 39th St., New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. M. W. Rice, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

"Engineering Data." Thirty-five new sheets on April list. Box 677, AMER. MACHINIST.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Mechanical drawing, light, accurate machine work. J. B. Poore, Washington, N. J.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

The Brunswick Refrigerating Co., of New Brunswick, N. J., are prepared to take on one or more manufacturing propositions.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Tools, jigs and fixtures designed for rapid productions; send blueprints for estimates. W. A. J. & Co., 596 Hyde Park Ave., Hyde Park, Mass.

Wanted—Work for gear cutters, hand turrets, milling machines, etc.; fine work in quantities. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Case hardening on carbon and alloy steels; with our new furnaces we are able to take on a little more work at this time. Boston Gear Works, Norfolk Downs, Mass.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Tools, dies, jigs and light and medium weight machinery designed and built to order; duplicate parts, either machined or die cast. Precision Die Casting Co., 422 So. West St., Syracuse, N. Y.

Are you looking for an exclusive agent on your goods for New York, Brooklyn and Long Island? We are in our new building open to do business. Edwin B. Stimpson Company, 68-70 Franklin Ave., Brooklyn, N. Y.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

$5000 cash buys valid patent on best, simplest, cheapest steel sprocket chain for autos and all classes of machinery ever produced; each link stamped in one piece; joints dust proof. Walter Hay, M.E., Seville, Ohio.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools, invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraphic Company, Baltimore, Md.

New York sales representation desired by graduate mechanical engineer for European or American firms manufacturing machinery or engineering equipment, preferably that could be demonstrated superior by installation test when necessary; new articles requiring a hustler to introduce them will receive due attention of a competent technical business representative. Box 685, AM. MA.

Wanted—Competent man with $5000 to take third interest in a sawmill and water right in northern California; good plant, 10,000,000 feet to cut and plenty more timber in sight; good water power; economical production; good market; water right will develop 20,000 horsepower and will be very valuable in near future; experience preferred, but not necessary; $5000 a year net profit. Box 650, AMERICAN MACHINIST.

We solicit and are prepared to do jobbing and manufacturing work of any kind and quantity; duplicate manufacturing, automobile parts, engines, light and heavy machinery, etc.; complete modern plant, machine, pattern, forge and sheet iron shops; large modern gray iron foundry; let us figure on your gray iron castings; can handle castings up to two tons each; private railroad siding. Sageng Threshing Machine Co., St. Paul, Minn.

Why not get more Russian business? (See AMERICAN MACHINIST of November 17, 1910.) Young sharp mechanical engineer with worldwide experience in organizing and managing business, desires to represent a first class American concern in Russia; machinery or tool steel preferred; speaks Russian and six other languages; knows Russia and her ways; applicant has been very successful in opening new territories; is expert in tool steel; is able to give security. Write for detailed information or interview, "Russia," AM. MA.

Pneumatic tools; German manufacturing company, Europe's largest and leading concern in air compressors and pneumatic tools, having developed these lines to a perfectness, exceeded by no other manufacturer in the world, and enabling it to meet every competition, is contemplating extending its sale to the United States, and solicits correspondence from American engineering or manufacturing concerns of first rank, having a large selling organization, for which the pneumatic tool line is adapted; a representative of the European company will arrive in New York about the middle of April. Address Box "P. L.," AMERICAN MACHINIST.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

ILLINOIS

Wanted—Experienced milling machine man to act as foreman milling machine department of concern manufacturing gasolene engines; must be strictly first class workman, resourceful and well recommended. Box 633, AMERICAN MACHINIST.

Wanted—Man thoroughly familiar with piece work and premium systems competent to lay out and plan work along the lines of the Taylor system; must be strictly reliable, competent and well recommended. Box 634, AMERICAN MACHINIST.

IOWA

Wanted—A first class man to take charge of tin-plating shop; state experience. Box 666, AMERICAN MACHINIST.

MASSACHUSETTS

Wanted—A planer hand; must be a married man, sober and industrious and one who will appreciate a steady job with good people and pleasant surroundings; in writing, state age, references, experience and wages expected; a good man wanted, no other need apply. Box 674, AMERICAN MACHINIST.

Wanted—To communicate with a young man thoroughly conversant with uptodate high-speed tools, one understanding heavy and light work and not afraid of new or repair work, preferably one who knows something about paper mill machinery; small shop; if interested write giving full details you would ask if you were hiring a man with the idea of his eventually being foreman. Address "R," AMERICAN MACHINIST.

MICHIGAN

Wanted—Young man experienced in making layout drawings of tools for steel stampings and pressed metal, under the direction of an engineer; must be rapid, accurate and thorough; in reply state experience, etc., and salary required. Address "Engineer," Box 25, AMERICAN MACHINIST.

Wanted—First class die maker as foreman of die department in manufacturing plant in central Michigan; must be experienced in blanking, combination and drawing dies in tin, brass and sheet metal; married man preferred; state salary expected and give references of last two employers; none but a steady first class die maker wanted. Address "M," AMERICAN MACHINIST.

Wanted—Applications for Cadillac Motor Car Company's instruction department course; only those will be considered who are 18 years old or over, do not use cigarettes or intoxicating liquors and who are willing to go through the entire two-year course, which consists of eight shop departments, tool drafting class work and also day class work; there is no auto repairing or driving given in this course. Apply between 1:30 and 2:30 p.m. Cadillac Motor Car Co., 1343 Cass Ave., Detroit, Mich.

NEW JERSEY

Wanted—A first class mechanical draftsman who has had general all-around experience, for steady position. Box 661, AM. MA.

Wanted — A bright, ambitious, capable draftsman to assist in designing light machinery; must be accurate and dependable; give references, experience and wages expected; steady position for the proper party. Box 624, AMERICAN MACHINIST.

NEW YORK

Young man wanted to sell tools and supplies; experience not necessary. Box 680, AMERICAN MACHINIST.

Wanted—Draftsman on power pump work; state age, character, education, experience and salary wanted. "Power Pump," AM. MA.

Wanted—A first class designer for special printing machinery; only those who can furnish the best of references need apply. Box 566, AMERICAN MACHINIST.

Draftsman—Technical graduate with two years' experience for steam turbine design; state experience and salary expected. Box 632, AMERICAN MACHINIST.

Wanted—Man with training and experience in structural work, furnaces, brick work, piping, etc., for drafting room; first class man only; give full particulars, stating age and salary required, to Box 679, AM. MACH.

Wanted—Chief inspector in automobile plant manufacturing sheet metal bodies, frames, brass and aluminum castings; must be a man who has had similar experience; steady position. Apply Factory Manager, Maxwell-Briscoe Motor Co., Tarrytown, N. Y.

Wanted—Assistant business manager, with good personality for a printing press manufacturing concern; technical and business experience in our line, absolutely necessary, and best of references; state age, references, experience and salary. Box 660, AMER. MACH.

Wanted—Assistant superintendent of large gas engine plant; applicant must be a mechanic and executive; do not apply unless you are at present employed and earning not less than $2500; all applications will be treated strictly confidential. Box 635, AM. M.

Wanted—A competent man to do general inspection work for a liability insurance company; must be qualified to assist and instruct other inspectors; expert knowledge of elevators required. Address, stating experience, education, age and whether married or single. Box 620, AMERICAN MACHINIST.

Wanted—Energetic machinist; must be expert operator on lathe, planer, drill press, boring mill and grinder; position will require employee to determine by actual test best obtainable time on various operations; an excellent future assured to a capable mechanic; state wages, experience and name references to receive consideration. Box 665, AMERICAN MACHINIST.

Wanted—Assistant foreman for grinding department on a line of high grade automobile work; successful applicant must be a man that has had a position of responsibility in that line, that understands the setting of piece rates and be uptodate on modern methods of grinding; no application will be considered that does not contain the following information: age, married or single, experience, firms employed by during the past six years, the position held with each firm, wages expected and when available; this is an exceptional opportunity for a good man; any reply will be treated confidentially on request. Address "Grinder Foreman," AM. M.

OHIO

Wanted—Horizontal boring bar and lathe hands; state age, experience and give reference. The Heisler Company, St. Marys, Ohio.

Wanted—Automatic screw machine operators on Cleveland and Gridley machines; men who have had experience on large work; no labor troubles; steady work the year around. The Timken Roller Bearing Co., Canton, Ohio.

Wanted—Machine shop superintendent for large gas engine manufacturing company; must be strictly uptodate in modern machine shop practice, with at least ten years' experience as foreman or superintendent; give complete experience, references, salary, etc. Box 673, AMERICAN MACHINIST.

Wanted—By a large firm manufacturing automobile parts, a foreman capable of taking charge of the automatic and hand turret department; limits required on work very close and only a man experienced in fine work need apply; state age, experience and salary wanted. Box 627, AMER. MACHINIST.

Draftsman and designer, experienced on sheet metal working machinery, power presses, punches, squaring shears, tinners' tools, etc.; growing concern, old established, newly built modern equipped plant; opportunity for advancement for competent ambitious man; must be experienced; state age, experience, references, salary expected to start with. Box 592, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Draftsmen—Several draftsmen on tools and automobile parts wanted by a firm in western Pennsylvania; state salary expected and when you can report. Box 667, AM. MACH.

Works superintendent for old established manufacturing company; must be thoroughly familiar with turret machinery, etc., and modern production methods. Box 586, AM. M.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—Fifty tool designers; experienced competent men in the design of jigs, fixtures, punches and dies and other special tools used in the manufacture of high grade machine parts on an interchangeable basis; apply by letter stating age, experience and salary required, as well as the date when you would be able to start if application was accepted. The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

TENNESSEE

Wanted—A foreman for jobbing machine shop employing about 20 machinists; a man with broad experience in general machinery required; give age, salary expected and references. Apply Box 663, AMER. MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

ILLINOIS

Designing draftsman on tools and special machinery, seven years' experience, shop and drafting room, desires change. Box 664, AMERICAN MACHINIST.

Manager or superintendent with practical knowledge of modern manufacturing methods, desires a position; experience includes direction of office, machine shop, foundry and auxiliary departments, maintenance of plant, motive power, electric apparatus, etc. Box 631, AMERICAN MACHINIST.

MASSACHUSETTS

Superintendent of shop owned by the manager. Box 617, AMERICAN MACHINIST.

Superintendent or general foreman, American, 40 years old, wide experience handling men, and reliable, desires to correspond with a going concern who is in need of such a man; now holding position as general foreman, but is looking for a similar position paying not less than $1800 per year, and an opportunity for investment in the business; any location and any line of manufacturing will be considered. Box 675, AMER. MACHINIST.

NEW JERSEY

Wanted—Position as foreman by first class blacksmith; age 34; 19 years' wide and practical experience; uptodate on modern methods, hardening and tempering; good organizer and work producer; now employed. Box 682, AMERICAN MACHINIST.

NEW YORK

A producer, twenty-five years' experience, open for superintendent or general foreman. Box 644, AMERICAN MACHINIST.

Correspondence student, age 22, desires position in drafting room; five years' experience in machine shops. Box 669, AMER. MACH.

Situation wanted by expert mechanical draftsman on automatic and special machinery or automobile work. Box 651, AM. MA.

Mechanical draftsman, technical graduate, seven years' experience, desires position in or near New York City. Box 662, AM. MACH.

Machine shop foreman, experimental work preferred; mechanical experience 20 years; technical education. New York only. Box 659, AMERICAN MACHINIST.

Experienced patternmaker seeks position as first patternmaker on small work; employed, but wishing a change; age 35. Box 658, AMERICAN MACHINIST.

Draftsman, 10 years' experience, shop and drafting, machinery and tool designer, now employed, wish change to Newark or New York City. Box 657, AMERICAN MACHINIST.

Assistant superintendent or assembling foreman, 12 years' experience in typewriters and similar machines; expert on production, systematizing and cost reduction; A-1 references. Box 684, AMERICAN MACHINIST.

A-1 cost clerk (30), with thorough knowledge of general detail work, machinery manufacturing; five years with last concern; good penman, quick and correct at figures; excellent references. Box 670, AMER. MACHINIST.

Centrifugal pump expert, graduated civil and mechanical engineer, 29 years of age, with a thorough practical and commercial experience, will shortly be open for engagement as New York representative for manufacturers making centrifugal pumps; have done extensive traveling; is a first class all-around man and will furnish best of references. Box 676, AMERICAN MACHINIST.

Superintendent wants a bigger job. If I could write an advertisement as well as I can run a shop, we would soon be discussing details; I have made three changes in 20 years, and the time has come when I intend to connect with the largest opportunity for responsibility and results that may be offered; my best hold is in the systematizing of factory processes, and developing the productive efficiency of men and machines, more especially along the lines of fine toolmaking and special machine design and construction; I will send an extremely interesting letter to any manufacturer who cares to go as far as asking particulars of "I. I. N.," AM. MACH.

OHIO

An experienced designing draftsman is open for position; 20 years' experience on Corliss steam engines, air compressors and rock drills; ambitious and capable; references, A-1. Box 672, AMERICAN MACHINIST.

Office man, 26, ten years' experience, desires responsible position with growing concern; capable correspondent; expert stenographer; thoroughly familiar with machine tools. Box 616, AMERICAN MACHINIST.

Designer, 36, seventeen years' experience on machine tools, jigs and special tools, desires position as chief draftsman or assistant superintendent; ambitious and capable; references. Box 668, AMERICAN MACHINIST.

Mechanical engineer, 31, technical graduate, general engineering and executive experience, maintenance, design and manufacture, desires position, superintendent, chief engineer, works manager or assistant; $2000. Box 681, AMERICAN MACHINIST.

Position with manufacturing concern employing from one to two thousand men; ten years' experience in cost, accounting, shop production and general office work; first-class references and good reasons for leaving present position; can earn $4000 a year; age 30 years. Box 641, AMERICAN MACHINIST.

PENNSYLVANIA

Superintendent; engineering, shop and foundry experience; good manager and can produce results; technical education; A-1 references. Box 638, AMERICAN MACHINIST.

Technical graduate, sixteen years' experience, wants position as works engineer; capable speed boss and production man; thoroughly familiar with modern methods and machinery; highest references. Box 678, AMERICAN MACHINIST.

Experimental foreman; capable of designing and carrying out ideas outlined by head; good organizer; used to carrying out of special machinery from start to finish; exceptional testimonials as to originality; would take sole management of small general engineers' plant; Englishman; 11 years' experience. Box 683, AMERICAN MACHINIST.

FOR SALE

For Sale—Newly patented friction clutch; just the thing for anyone wanting a good article to manufacture. Box 656, AM. MACH.

Second-hand steam hammer for sale; 6-ton double frame hammer in good condition, which was replaced by a high speed forging press; immediate delivery. United Engineering & Foundry Co., Pittsburg, Pa.

Manufacturing business; outright or part; dies, presses and special machinery; established trade with best concerns in the United States; reason sickness. Box X-40, AMERICAN MACHINIST, 150 Michigan Ave., Chicago.

One 16-spindle Baush drill, excellent condition. One Bement-Miles boring mill with chucks for 3¾x7, 4¼x8 and 5x9 railroad journal bearings; excellent condition. One Leland-Faulconer wet tool grinder. One old style Twiss-Hayes shaper. Will sell cheap. Box 643, AMERICAN MACHINIST.

Talks With Our Readers

By The Sales Manager

We were talking with an engineer the other day—an engineer who in the past seven years has placed orders for over a million dollars.

He said that before we began the talks on this page he discounted by half practically all the statements made in advertisements.

He always looked through the selling section—he was afraid not to for fear he would miss something new, something that would make his work easier and profits greater.

But he took everything with a grain of salt—a big one.

To his mind advertising was tainted.

When he thought of it a picture of patent medicine cure-alls or some other "claim-the-earth-and-the-fullness-there of" advertising came up.

He little realized that reputable magazines discontinued two or three years ago the practice of inserting questionable advertising.

He did not know that we spent between ten and fifteen thousand dollars each year trying to make the advertising columns of the AMERICAN MACHINIST interesting, informative and accurate.

He did not know that we refuse objectionable advertising—in fact, all advertising of products not directly in the machine-making line.

As a result of the confidence that he now has, he's getting a great deal more profit and pleasure out of the Selling Section. A feeling of distrust often blinds us to real opportunities.

Of course, he makes due allowance for the natural enthusiasm that a manufacturer has for his product.

There never was a father who didn't claim and couldn't prove that his baby was the best.

He knows that it's his job to analyze the claims of different manufacturers and buy the products that best suit his special requirements.

* * *

More and more of our readers appreciate all this and realize that they are safe when they buy equipment advertised in the AMERICAN MACHINIST.

* * *

Here's another case in point:

THE AMERICAN MACHINIST,
No. 505 Pearl Street,
New York, N. Y.

Gentlemen:

The care with which your readers look over the advertising pages of the AMERICAN MACHINIST was forcibly called to our attention recently.

A concern in Europe ordered a radial drill through our agent and specified that it was to be exactly like the drill advertised in the European Edition of the AMERICAN MACHINIST. We furnished this at once, but inadvertently omitted to send blue prints explaining the details of the machine.

When the customer received the machine he did not understand some of the attachments and refused to accept it as it was, stating that it was not like the one advertised.

Of course our blue prints explained everything, but this only goes to show what faith your readers have in your paper, and how they insist that all statements in ads be lived up to.

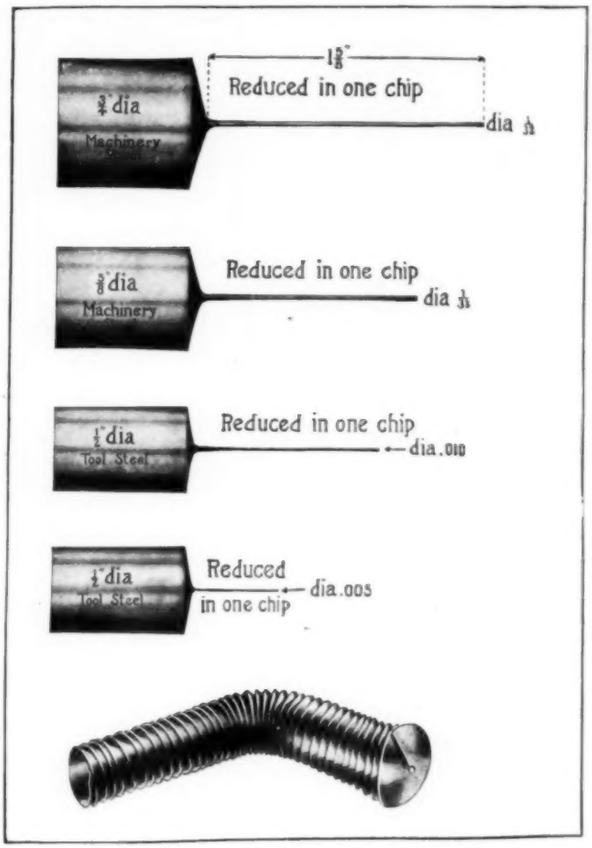
Yours very truly,

PRENTICE BROS. CO.,
Per A. E. Newton.

* * *

Only reliable products can be continuously advertised.

Samples of Work Turned on the Rivett Lathe



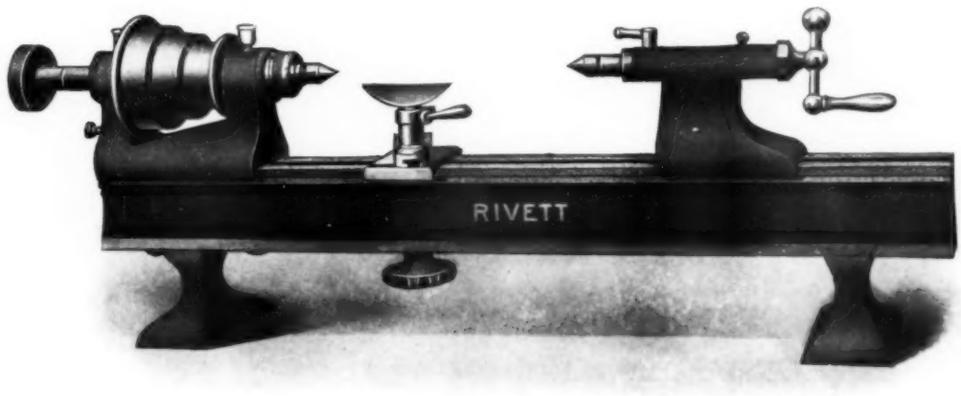
TRY this on your lathe and see if you can reduce the stock in one chip, and leave a nice smooth center .005, .007 or .010 in diameter.

You can do this on "The RIVETT" lathe, because it is built on the right principle, together with the greatest care and skill. All RIVETT Lathes have Spindles made of the best tool steel, hardened, ground and lapped to a perfect bearing. The Thread on the nose of all the Spindles is ground, which insures the true running of face plates and chuck closers.

The Tailstock Spindles are also hardened, ground and lapped, which gives them their smooth sliding fit combined with "Rigidity," the characteristic feature of the RIVETT Lathe.

No progressive shop can afford to be without a RIVETT Lathe. Some of the best tool makers specify it, as they know it has been the leader for twenty-seven years.

Write for Catalog No. 27.



No. 4 Lathe. Price, with countershaft, $125
Write for catalog giving full description.

The Rivett Lathe Manufacturing Company

Brighton, Bostor Mass.

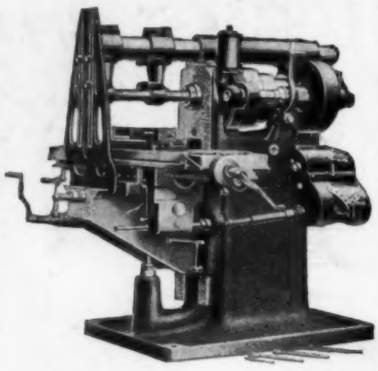
Rivett Lathes are carried in stock by Hill, Clarke & Co., at New York, Philadelphia and Chicago; Pacific Tool and Supply Co., San Francisco, Cal.; and by Motch & Merryweather Machinery Co., at Cleveland.

B. & S. Angular Cutters

These cutters are exceptionally difficult to make owing to the trouble found in hardening the points. Those marked "B. & S. Mfg. Co." meet exacting requirements.

See page 55

Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.



LE BLOND

MILLERS

Eight Sizes of Plain.
Six Sizes of Universal.

Send for Catalog

The R. K. LeBlond Machine Tool Co.,
Cincinnati, Ohio.

The Wm. H. Bristol Electric Pyrometers

Write for 56 page illustrated catalogue No. 130 of the Wm. H. Bristol Electric Pyrometers giving a partial list of users including the names of more than 100 concerns using these Pyrometers in connection with Hardening & Annealing Furnaces

The Bristol Co., Waterbury, Conn.

Save Chucking Time By Using Walker Magnetic Chucks

They have proved their practicability for holding iron and steel work having flat sides, on planers and surface grinders.

Over 3000 now in successful use. They soon save their cost in putting on and taking off work. 30 styles and sizes.

Ask for details and prices.

O. S. Walker & Co., **Worcester, Mass., U. S. A.**

P. P. P.

Three CLEVELAND Tools That Save

No. 3

"PEERLESS" High Speed REAMERS

Can be run at more than double the speed of ordinary reamers. The "Peerless" method makes them tougher than any other High Speed Reamer, yet cuts the cost nearly in two. All "Peerless" styles can be furnished as Expanding Reamers—impracticable with other High Speed Reamers.

WATCH THIS SPACE FOR THE 3 Ps.

The CLEVELAND Twist Drill Co.

New York **CLEVELAND, OHIO** **Chicago**